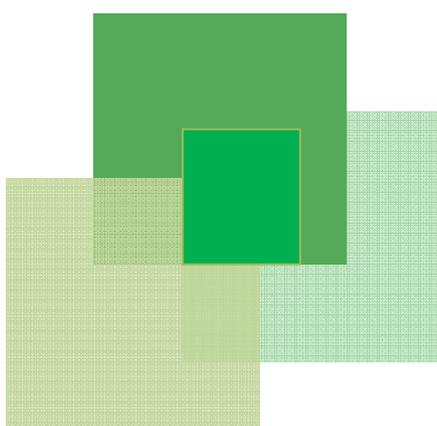




International
Labour
Office
Geneva



Skills for green jobs in Costa Rica

Unedited background country study

Sanola Daley
Luis Reyes
Edwin Vega
Wendy Alfaro

INCAE Business School

ILO Skills and
Employability
Department

2010

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First published 2010

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ILO Cataloguing in Publication Data

Daley, Sanola; Reyes, Luis; Vega, Edwin; Alfaro, Wendy

Skills for green jobs in Costa Rica : unedited background country study / Sanola Daley, Luis Reyes, Edwin Vega, Wendy Alfaro ; International Labour Office, Skills and Employability Department. - Geneva: ILO, 2010

1 v.

ISBN: 9789221239734 (web pdf)

International Labour Office; Skills and Employability Dept

skill / skill requirements / vocational training / training needs / green jobs / employment creation / climate change / environmental protection / Costa Rica

13.02.2

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Printed in Switzerland

Foreword

The world finds itself in a slow recovery after the deepest recession since the Great Depression. The world is also coping with a host of environmental problems and the urgent need to reduce carbon emissions. A greener future also promises an enormous potential in a much needed employment growth. However, without suitable skills, this potential cannot be realized. Today, skills gaps are already recognized as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services, and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs. Effectiveness of training measures is decisive not only for the economic recovery but also for a longer-term sustainability agenda.

This report was produced in the framework of the project, 'Skills for green jobs'. The project was implemented in cooperation between the International Labour Organization (ILO) and the European Centre for the Development of Vocational Training (Cedefop). The project identifies skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The 'Skills for green jobs' study is embedded in the Green Jobs Initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyze and promote the creation of decent jobs as a consequence of the needed environmental policies. The global study was jointly funded by the Skills and Employability Department of the ILO and the Green Jobs Initiative.

The following countries have been included in the study: the ILO covered Australia, Bangladesh, Brazil, China, Costa Rica, Egypt, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Thailand, Uganda and the United States. In addition, Cedefop covered six European Union (EU) member States: Denmark, Estonia, France, Germany, Spain and the United Kingdom. The ILO global synthesis report,¹ which analyzes the situation in all 21 countries involved in the study, and the European synthesis report,² which covers the six EU countries, as well as all individual country reports, are available at: http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm (the ILO website) and <http://www.cedefop.europa.eu> (Cedefop website; look under *Skills Needs* theme). The unedited background country studies have been published in the electronic form in order to make them available quickly. The summaries are published as part of the synthesis reports.

¹ Strietska-Ilina, O.; Hofmann, C.; Duran Haro, M.; Jeon, S. (forthcoming 2010). *Skills for green jobs: A global view. Synthesis report based on 21 countries* (Geneva, ILO Skills and Employability Department).

² Cedefop. (forthcoming 2010). *Skills for green jobs: European synthesis report* (Luxembourg, Publications Office of the European Union).

The global project in the ILO was coordinated by the Skills and Employability Department and, in particular, benefited from comments and technical guidance by the team under the leadership of Olga Strietska-Ilina, Christine Hofmann, Mercedes Duran and Shinyoung Jeon. The ILO coordinating team would like to express great thanks to the authors of the report, Sanola Daley, Luis Reyes, Edwin Vega and Wendy Alfaro of the INCAE Business School, for their background country research which contributed to the global study. Special thanks also go to the ILO regional and country field offices for the project support and the ILO colleagues who assisted research at national level.

Christine Evans-Klock
Director
Skills and Employability Department, ILO

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Abstract

In the past few years, Costa Rica has positioned itself as a world-leading model in sustainability. The government has started numerous initiatives like the Climate Change Strategy and the Peace with Nature Initiative to maximize the country's greening potential. Within this national context, research was carried out by INCAE Business School based on The Green Jobs Initiative mandate to assess, analyze and promote the creation of new jobs and the structural changes for the transformation of the existing ones. An integrated quantitative and qualitative methodology was used to obtain reliable data for current green jobs trends. Several interviews and focus groups with representatives of the public and private sectors were carried out. Data analysis revealed that new-collar jobs are scattered along the country. Academic institutions have developed new green positions. Moreover, existing occupations are becoming greener. Professionals are increasing their awareness in sustainability topics. For gender implications, an increasing number of women are receiving education in male-dominated fields such as engineering, agriculture, natural resources management and energy. Also, to obtain a wide perspective of Costa Rica's current labour market situation, seven case studies were developed. Cases topics include: (re)training needs, new green collar jobs and greening existing occupations. Even though the government has been proactive in developing initiatives and programs related to sustainability, there are still important policies and educational steps that must be taken to achieve the country's goals and keep a competitive position worldwide.

Executive summary

This report summarizes key findings obtained from research conducted by INCAE Business School regarding the creation of green jobs and the transformation of existing jobs as a result of sustainable development and low-carbon trends in Costa Rica. The study was conducted within the context of The Green Jobs Initiative – a joint initiative by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC).

In recent years, Costa Rica has positioned itself as a world-leading model in sustainability. Numerous initiatives such as Climate Change Strategy and the Peace with Nature Initiative have been developed to steer the country in the right direction to maximize its goals in its greening potential. Main challenges and priorities related to climate change have provoked a national shift, which will require the creation of new green jobs, re-training or greening of existing ones in order to meet specific environmental goals.

As defined by UNEP, ILO, OIE and ITUC (2008), green jobs are positions in agricultural, manufacturing, research and development (R&D), administrative, and services that contribute substantially to preserving or restoring environmental integrity. This includes occupations that help protect ecosystems and biodiversity, reduce energy, materials and water consumption through high-efficiency strategies; de-carbonization of the economy; and minimization of waste and pollution.

To accomplish research purposes, an integrated quantitative and qualitative methodology was implemented in order to obtain good reliable data and an accurate explanation for current trends. Existing secondary sources of information were analyzed to understand Costa Rica's main priorities as a "green economy". Moreover, interviews and focus groups with representatives of the public and private sectors were carried out. Data omissions may be present in this report due to the lack of trustworthy statistics on green jobs creation, skill responses and trends.

Data analysis and interviews results revealed that new-collar jobs in Costa Rica are scattered along the country. Academia and research have created many new positions, particularly by institutions such as CATIE Center for Tropical Research and Education (Centro Agronomico Tropical de Investigacion y Ensenanza), INCAE and EARTH University. These jobs have been created to oversee natural resource management, climate change and energy efficiency issues and also to develop a complete curricula needed to meet the specific needs of the competitive private sector.

Existing occupations in Costa Rica are becoming greener. Professionals who already have a position within a company are seeing the need to change to increase their sustainability awareness. Focus groups responses have pointed out that many greening initiatives are being undertaken by private companies on their own and some in response to the government's objective to make the country carbon neutral. In addition, environmental consumers in Europe and the United States are demanding sustainable products and services. This trend has significantly impacted Costa Rica's agriculture and tourism sectors. Some skills required for greening are: measuring carbon footprint, tracking savings as energy efficiency measures, project financing and feasibility, negotiation skills, and proficiency in foreign languages, among others.

As for gender implications within the greening occupations context, main affected sectors and industries (engineering, agriculture, technology and energy) are male-dominated. However, an increasing number of women in Costa Rica are receiving formal and technical education in these fields and are seeking job opportunities in natural resources management, tourism, and education, among others.

In the country, nearly 25 of the total of 56 universities and 74 vocational schools offer degree and certificate programs in natural resource management. Fields of study include tourism; agro-industry and fishing; natural sciences; industrial, mechanical and electrical engineering; business administration, including corporate social responsibility; energy; project management, finance and others. Within the country there are opportunities for Technical and Vocational Education and Training (TVET), Continuing Vocational Education and Training (CVT), on-the-job training programs as well as other external training programs.

Skill needs analysis included seven case studies with the objective to obtain a wide perspective of Costa Rica’s current labour market. Cases were divided in three main categories (Figure 1):

- Case studies on (re)training needs;
- Case studies on new green collar occupations;
- Case studies on new types of skills, competences and skill gaps.

Figure 1. Case studies distribution by company and/or topic

Re-training Needs	New Green Collar Jobs	Greening Existing
Carbon Neutral PROGRAM	INCAE DOLLA Waste management INTEL	Precision Agriculture Ramada Plaza Herrecura

Lastly, the Government has been proactive in the development of programs and policies related to sustainability. As a consequence, in order to achieve the country’s goals, a national entity to oversee the creation of a green economy must be created. Moreover, national indicators should be defined to assist actors in the design and implementation of strategies to educate people. All students must understand the implications of the environmental management in their field to prepare as future professionals for new green collar occupations and the greening of existing ones.

Abbreviations and acronyms

AP	Advanced Placement
CANATUR	National Chamber of Tourism of Costa Rica
CAPEX	Capital expenditure
CATIE	Center for Tropical Research and Education (Centro Agronómico Tropical de Investigación y Enseñanza)
CICR	Costa Rica Industry Chamber
CIEA	Inter-University Environmental Education Commission
CIMS	Center for Sustainable Markets Intelligence
CINDE	Costa Rican Investment Promotion Agency
CLACDS	Latin American Center for Competitiveness and Sustainable Development
CNFL	Compañía Nacional de Fuerza y Luz
COESA	Eastern Operating Consortium S.A.
CONAGEBIO	National Commission for the Management of Biodiversity
CONARE	National Rector Council
CONESUP	National Higher-Education Council
CSR	Corporate Social Responsibility
CST	Certification for Sustainable Tourism
CVT	Continuing Vocational Education and Training
CYMA	Competitiveness and Environment Program
DIGECA	Department of Environmental Quality Management
EARTH	EARTH University
ECAGIRH	Central American Water Management Strategy
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
ENCC	Estrategia Nacional de Cambio Climático
ERAS	Regional Agro-Environmental and Health Strategy
ESCO	Energy Services Company of INCAE
EU	European Union
EUREPGAP	currently GLOBALGAP
FLACSO	Latin American Faculty of Social Sciences (La Facultad Latinoamericana de Ciencias Sociales)
FONAFIFO	Fondo Nacional de Financiamiento Forestal
GAP	Good Agriculture Practices
GDP	Gross domestic product
GHG	greenhouse gas
GIS	Geographic Information Systems
GLOBALGAP	formerly EUREPGAP

GMA	Costa Rica's Greater Metropolitan Area
GNI	Gross National Income
GPS	Global Positioning Systems
GTZ	German Technical Cooperation Agency
HSD	Hybrid Synergy Drive
IB	International Baccalaureate
ICAFE	Instituto del Café de Costa Rica
ICAP	Instituto Centroamericano de Administración Pública
ICE	Costa Rican Electricity Institute (Instituto Costarricense de Electricidad)
ICT	Costa Rican Tourism Institute
IEE	Institute for Business Excellence (Instituto de Excelencia Empresarial)
IFAM	Instituto de Fomento y Asesoría Municipal
ILO	International Labour Organization
INA	Instituto Nacional de Aprendizaje
INCAE	INCAE Business School (or Central American Institute of Business Administration)
INCOPESCA	Instituto Costarricense de Pesca y Acuicultura
INEC	National Institute of Statistics and Census (Instituto Nacional de Estadísticas y Censos)
INTA	Instituto Nacional de Tecnología Agropecuaria in Argentina
IOE	International Employers Organization
IPCC	International Panel on Climate Change
ITCR	Costa Rica Institute of Technology or Technological Institute of Costa Rica (ITEC) (Instituto Tecnológico de Costa Rica)
ITEC	Instituto Tecnológico de Costa Rica
ITUC	International Trade Union Confederation
LEED	Leadership in Energy and Environmental Design
Ley GIR	Integrated Solid Waste Management Law
MARN	Masters in the Administration of Natural Resources
MEP	Ministry of Public Education
MICIT	Ministry of Science and Technology
MINAE	Ministry of Environment and Energy
MINAET	Ministry of Environment and Energy and Technology
MINETREM	Ministry of Natural Resources, Energy and Mines
OLADE	Latin American Energy Organization
OPES	Superior Education Planning Office
PACAGIRH	El Plan Centroamericano de Gestión Integrada de los Recursos Hídricos
PCGIR	Regional Integrated Risk Management Strategy
PLACEA	Latin American Plan for Environmental Education

PRESOL	Costa Rica Solid Waste Plan
PRUGAM	Plan Regional Urbano de la Gran Area Metropolitana
QMS	Quality Management System
R&D	Research and Development
SACS	Southern Association of Schools
SETENA	National Environmental Technical Secretariat
SIGGAM	GAM Information System
SINAC	National System of Conservation Areas
SMEs	small and medium enterprises
SMP	Sustainability Management Program
TVET	Technical and Vocational Education and Training
UCR	University of Costa Rica (Universidad de Costa Rica)
UNA	Universidad Nacional
UNED	Universidad Nacional Estatal a Distancia
UNEP	United Nations Environment Programme
UTN	Universidad Técnica Nacional de Costa Rica
UTUR	University of Tourism

1. Introduction

In recent years, Costa Rica has succeeded in positioning itself as an environmentally-conscious developing country at the vanguard of sustainable development. This is not by chance; specific policies and programs have been put in place at the government level which have trickled down and been matched by members of the private sector and different civil society actors. This has, in turn, set in motion the greening of the Costa Rican public administration, society and economy. This greening has implications for all industries and human activity, including in the areas of energy, transportation, construction, manufacturing, tourism, waste management, and agriculture, among others. Human capital continues to be the driving force behind the economy and therefore the facilitators of the changes towards environmental sustainability. The country's human capacity is integral to the successful implementation of the requisite changes through capacity building in the form of knowledge transfer and skills development.

This study will examine in greater detail the challenges and priorities related to climate change and greening policies and strategies in Costa Rica, paying particular attention to the principal sectors with greening potential and government policies and incentives. Central to this discussion will be the skills response strategies in the different areas, examining therefore how education and training (including on-the-job) programmes seek to create the capacity necessary to facilitate a national shift. The paper will analyze the different skills needs for new occupations, as well as the new skills and re-training needs for already existing professions, and any policy, programmatic and technological shifts that these may bring about. Methods, tools, systems and institutional frameworks for this skills response will be examined and assessed to determine what gaps remain in planning and implementation for the skills responses from all strategic actors. The paper will then draw conclusions and provide the recommendations for the adequate skills policies and strategies at the different levels.

The objective of the assignment is to identify strategic skills development responses of the country in the light of environmental degradation, climate change and the global call for greening economies.

Methodology

The study will encompass a mixture of quantitative and qualitative research methods, in order to present a complete view of the country's reality. A thorough analysis will be carried on existing information from relevant secondary sources which would foster an understanding of the key challenges and priorities for Costa Rica in the creation of a "green economy". In addition, interviews and focus groups with representatives of different public and private sector organizations from a range of industries and skills levels help to identify the areas of concern, challenges and opportunities present in the country. Focus group participants will include representatives from large, small and medium companies involved in tourism, construction, manufacturing, energy, transportation, waste management, market research institutions such as the Center for Sustainable Markets Intelligence (CIMS), business associations such as the Costa Rica Industry Chamber (CICR),

university professors, educators and training specialists, representatives from the Ministry of Environment, Education, Labour, human resource experts and other relevant stakeholders. Annex A shows a list of the Focus Group participants and the persons interviewed.

Limitations to the study

It must be acknowledged that there may be information gaps for indicators and data at the national and international level for some data relevant to this study, as Costa Rica is just now beginning to organize research and data on the creation of a green economy. There is limited availability of national statistics on green job creation, as well as skills responses and trends, thus affecting the ability to gather relevant quantitative data. The report therefore relies heavily upon information provided through qualitative means such as focus groups, interviews and revision of available policy documents.

2. Policy context

2.1 Key challenges and priorities for the green economy

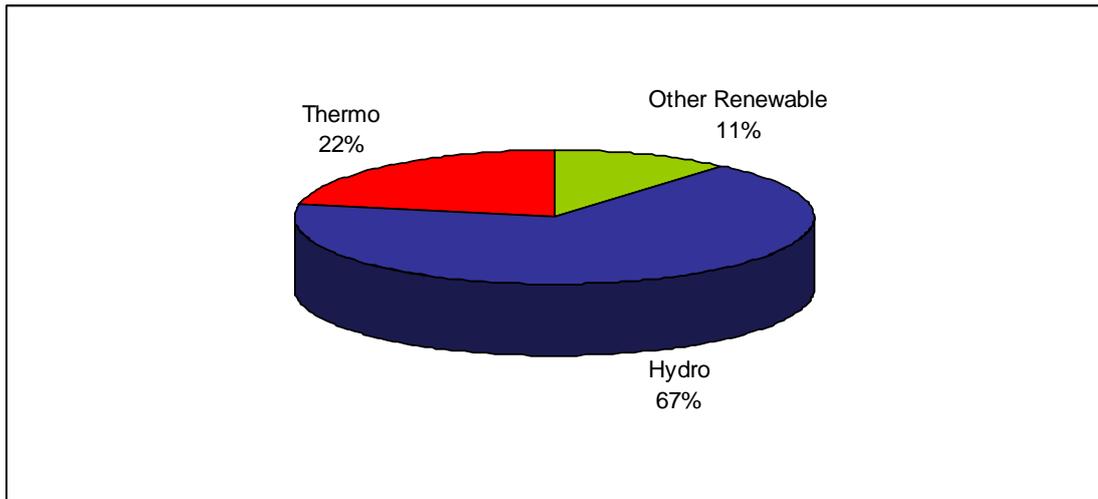
Costa Rica is home to more than 4.53 million people. One of the most vibrant economies in Central America, the country has a GDP (gross domestic product) of US\$29.83 billion and a per capita GNI (Gross National Income) of US\$6,060.³ Agriculture currently accounts for 7 per cent of the GDP, while Industry and Services account for 29 per cent and 64 per cent respectively. Tourism is now the country's principal foreign exchange earner, with a focus on ecotourism in line with Costa Rica's efforts at environmental conservation. Costa Rica possesses approximately 4 per cent of the world's biodiversity as well as three world heritage sites, eleven wetlands and two biosphere reserves. In addition, the Peace with Nature Initiative, to be further discussed in Section 2.2.1, estimates that 26 per cent of the total land surface of Costa Rica is within a protected area.⁴

Costa Rica has also been a pioneer in the production and utilization of clean energy. The state-run Costa Rican Electricity Institute (*Instituto Costarricense de Electricidad*, ICE) in the 1950s decided to shift to hydropower, later adding eolic and geothermal energy. Currently, Costa Rica has a Hydropower potential of 6,411.49 megawatts, and is less dependent on fossil fuels than many of its neighbours (see Graph 1).

³ World Bank data (2008).

⁴ Peace with Nature Conceptual Document 2007, available at:
http://www.pazconlanaturaleza.org/admin/descargas/upload/DOCUMENTO_CONCEPTUAL.pdf

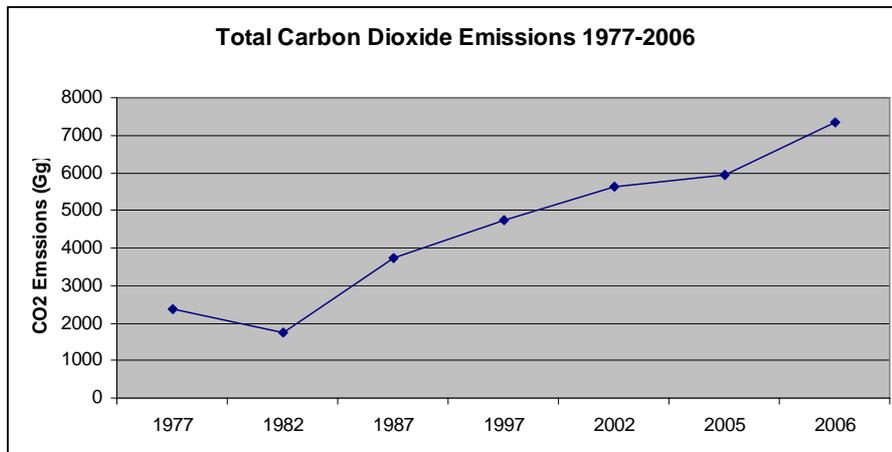
Graph 1. Installed electricity capacity by type, 2006



Source: Latin American Energy Organization (OLADE) (2007).

In spite of its widespread usage of clean energy, Costa Rica has continued to experience growth in CO₂ emissions, as evidenced by 75 per cent increase in emissions from the industrial sector between 1997 and 2006 and a 315 per cent increase in transportation for the same period (See Graphs 2 and 3).⁵

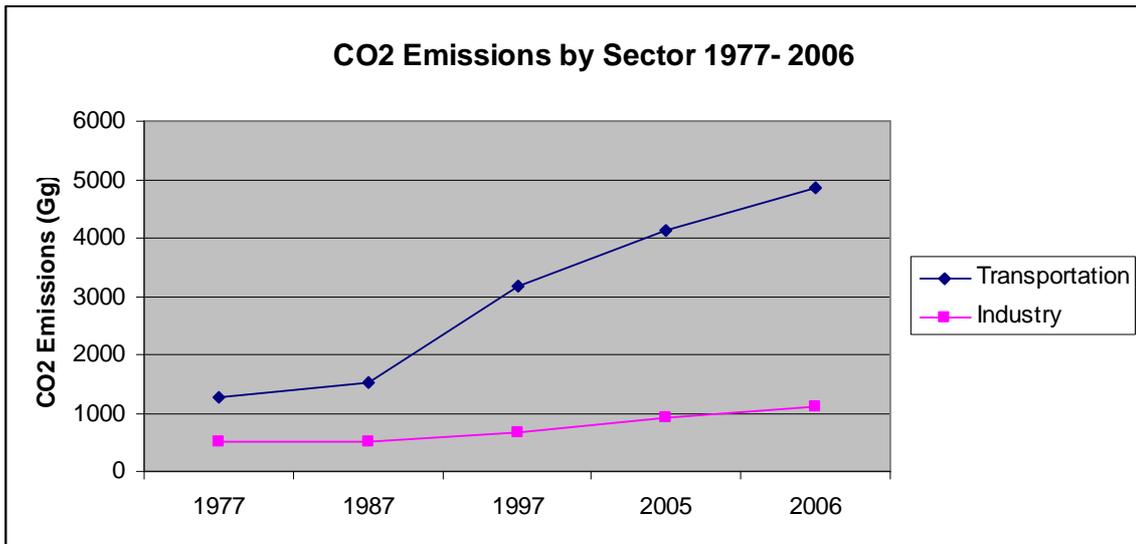
Graph 2. Total CO₂ emissions from Costa Rica, 1977-2006



Source: OLADE (2007).

⁵ OLADE (2007), Energy Statistics Report 2006.

Graph 3. CO₂ emissions from transportation and industry, Costa Rica, 1977-2006



Source: OLADE (2007).

This data demonstrates that there may be gaps between policies and implementation across different sectors in society. While much priority has previously focused on Costa Rica's energy industry and has led to successful greening, the data demonstrates clearly that there is significant greening potential for sectors such as transportation and industry, which have both seen an increase in greenhouse gas (GHG) emissions over the last 30 years, particularly for the transportation sector where emissions have more than quadrupled.

It is possible that despite the existence of systems such as Payment for Environmental Services (fuel tax), the steady increases in emissions reported may be due to a significant increase in private vehicles and transportation companies operating taxis or small buses, which have led to traffic congestion thus causing vehicles to give off increased emissions. The transportation sector's dependence on fossil fuel for transportation is an important factor here, as biofuels for transportation energy are still being explored. There has been an expansion of industry in Costa Rica as more free zones are continually opening and as more multinational corporations establish operations in Costa Rica. The increase in emissions reported may be due to an increase in industry players whose operations which have yet to become carbon neutral.

Major priority areas and challenges for Costa Rica

According to the Peace with Nature Initiative, Costa Rica's priority areas are climate change, organization and funding of the national system of protected areas, water resources, energy, waste management, education, tourism, marine resources, land use and the treatment of toxic and hazardous materials. It must be highlighted that energy for transportation should be considered of high priority. Currently, Costa Rica's energy needs for the transportation sector are filled by fossil fuels. As stated previously, emissions from transportation have been rising steadily for the last few decades, perhaps due to greater traffic congestion, particularly around the Great Metropolitan Area (GMA). Rather than depending upon the public

transportation system, many Costa Ricans purchased their own vehicles, a measure which has compounded the traffic situation in the country. As such, thousands of commuters sit in slow-moving traffic each day, burning unclean fuel. This factor may be one of the causes for the increases in the emissions mentioned in Graphs 2 and 3.

The target areas identified are crucial for the greening of processes and practices in all sectors. The country's challenges therefore are not only to define goals for the long, medium and short term, but also to organize the political and financial systems correspondent and encourage the active participation of the different actors in the society by engaging them in dialogue and action plans. The government believes that public institutions should establish the institutional standards, and therefore there is now an active campaign to green public administration throughout the country.

Undoubtedly, one of the most important challenges for Costa Rica's greening is human capacity development. Without the adequate and appropriate education and skills development to be transferred to different jobs and professions within the economy, greening will not take place⁶.

The shift from policy to action demands capable and knowledgeable individuals at all skill levels, including garbage collectors, teachers, industrial engineers and tour guides. Costa Rica's education and training systems and facilities must be active in forming a citizenry capable of leading and contributing to the greening of the economy, as this will affect their decisions and actions. As discussed in the focus groups, which drew on professionals of different public and private sector entities including education, greater sensitivity to climate change and environmental management issues must come about because of education.

These issues are central to the greening process. The transfer of knowledge to different members of the society through educational channels is necessary for changes to attitude and ultimately behaviour. A greater awareness of, as well as training on, the relevant issues and processes would enable legislators, consumers and private sector representatives to make expand the legislation, course offerings, and economic opportunities needed to develop a green economy.

The topic of green jobs is just beginning to take precedence in Costa Rica. While there is a core of professionals from different fields now working in environmental management and other areas which can be considered green or greening, focus group participants pointed out that there was still a dearth of professionals in the country who could consult on issues related to greening or adequately communicate, train and educate the wider society about climate change, or greenhouse gases, for example.

⁶ In the cases studied in Section 3, it is evident that companies found the new staff required in the labour market.

2.2 The response strategy

2.2.1 General environmental strategy

The protection of the environment has been an area which has received much attention in Costa Rica for several decades due principally to the consciousness regarding the socio-economic importance of the resources which the country possesses, and the need to utilize these resources in a manner that ensures sustainable development.

a) Establishment of natural parks

The establishment of wildlife preservation areas dates back to 1945 when the Robledales area along the Inter-American Highway south of Cartago was declared as a national park. In 1955, the law which created the Costa Rican Institute of Tourism also protected the areas around the craters of all volcanoes in the country. During this period, the Irazu Volcano National Park and the Turrialba Volcano National Park were established by Law No. 1917.

In 1963, the *Cabo Blanco Absoluta* Nature Reserve was established and later the Forestry Law of 1969 founded the Department of National Parks thus creating the establishment of national parks, biological reserves, protected zones, wildlife refuges and one national monument.

Law No. 6084 (1977) created the National Parks Services under the guidance of the Ministry of Agriculture and Farming, a measure which strengthened the process of establishment and consolidation of more protected wildlife areas. In the 1970s, more national parks were created. In 1988 an administrative decision was taken to place the National Parks Service under the Ministry of Natural Resources, Energy and Mines, and this enabled the creation of Law No. 7152 of 4 July 1990. Areas of Conservation were created to facilitate management of wildlife areas and the protection of the biodiversity in an effort to integrate to protected wildlife areas within a national system of regional units.

Beginning in 1995, Law No. 7554 on the Environment united the Forestry Department, the Wildlife Department and the National Parks System and converted the Ministry of Natural Resources, Energy and Mines (MINETREM) into the Ministry of Environment and Energy (MINAE, later known as MINAET with the inclusion of Telecommunications), thus paving the way for the Biodiversity Law (1998) and the establishment of the current National System of Conservation Areas (SINAC, by its Spanish initials).

b) Structure of MINAET

The SINAC currently administers 126 protected areas. In addition to the SINAC, MINAET also oversees:

- The Department of Environmental Quality Management (DIGECA), which was created in 2002 with the goal of implementing and designing the conceptual, technical and legal tools to define strategies and public policies in the area of environmental quality. These tools favor the prevention, mitigation and reversion of the degradation of hydro, air, and soil resources. At the same

time, these establish the mechanisms of monitoring and control which guarantee the completion of these goals.

- The National Environmental Technical Secretariat (SETENA), whose function is to oversee, study, analyze, monitor and evaluate the environmental impact studies of the productive activities taking place in the country. SETENA also grants the necessary environmental permits for the execution of public and private infrastructure development.
- The Environmental Administrative Tribunal, which was created by the Environment Law No. 7554 and the Executive Decree No. 25084-MINAE, has the mission of ensuring the compliance of the Tutelary Legislation of Environmental and Natural Resources through environmental resolutions and conciliations. These resolutions are obligatory and above appeal, and the administrative leverage to prevent damages that are difficult or impossible to repair, and employed to determine the compensation for environmental damages that offenders against environmental laws should pay for the benefit of public and private institutions, as well as civil society.
- The National Commission for the Management of Biodiversity (CONAGEBIO), created by Article 14 of the Biodiversity Law, No. 7788 (30 April 1998) with the aim of consolidating a national technical authority that dictates conservation policies, the ecologically sustainable usage and restoration of biodiversity. This authority also serves as a consultative body for the executive and the autonomous institutions in the area of biodiversity, in this way they should carry out international consultations to the Commission before authorizing national and international agreements, or to establish and ratify actions or policies that inspire the conservation and the use of biodiversity.
- Most recently, the National Climate Change Strategy⁷, overseen by MINAET.

c) **Peace with Nature Initiative**⁸

Costa Rica, using the Kyoto Protocol as its basis, has undertaken a series of actions with the purpose of developing and integrating scientific information in order to facilitate the decision-making to confront the potential climatic impacts resulting from global warming.

In this sense, the Government of Costa Rica was able to put forward a Climate Change Agenda from the highest national level, incorporating it into Costa Rica's National Development Plan 2006-2010, creating the Peace with Nature Initiative (established 6 July 2007) and in the Government Council Agreement (1 August 2007).

For Costa Rica, the proposals imply development of both a domestic and international agenda. Both agenda intersect in the focus on the attainment of environmental sustainability for the maintenance and recuperation of the ecosystems that support life on Earth.

The Peace with Nature is the initiative of President Oscar Arias to confront the environmental degradation that the country and the planet has been suffering.

⁷ <http://www.encc.go.cr/index.html>. The Strategy will be further discussed in Section 2.

⁸ <http://www.pazconlanaturaleza.org/>

The Initiative aims to be a facilitator that assesses and supports the Presidency of the Republic in the coordination, implementation and follow-through of the strategic intervention processes in Environmental and Sustainable Development issues, at the national and international levels.

The Initiative proposes internal actions in Costa Rica such as:

- Measures to make Costa Rica into a carbon neutral country by 2021.
- Development and execution of Environmental Management Plans in all government bodies.
- Promotion of increased forestry cover and the protected areas system.
- Inclusion of Environmental Education for Sustainable Development in the public education curriculum.

The Peace with Nature Initiative also seeks opportunities internationally to lead a campaign for environmental protection against the effects of climate change. The most significant challenges, in this sense, are:

- Create and lead an international network of carbon- neutral countries.
- Promote financial mechanisms for the protection of primary forests.
- Promote Carbon Credit exchange
- Support an international tax for carbon emissions

In the public sector, the Ministry of Environment and Energy takes the leadership at both the national and international levels with respect to climate change, and has made the commitment to make the country become carbon neutral. To face this challenge and develop Costa Rica's National Climate Change Plan, the National Strategy on Climate Change office was created. The National Strategy on Climate Change unites a diverse group of specialists to focus on the climate change within the framework of the International Panel on Climate Change (IPCC) with the objective of maximizing competitiveness and minimizing the risks in the different socio-economic sectors of the country.

d) National Climate Change Strategy⁹

The National Climate Change Strategy is a government initiative which seeks to respond to the global problem of climate change with a national focus. The Strategy benefits from an active participation from the different actors and both the public and private sectors. The strategy includes four fundamental bases and five points of action. The fundamental branches are shared responsibility, opportunity, threat and development capacity, and legitimacy to have international influence on climate change. The five points of action include: (1) mitigation, (2) vulnerability and adaptation, (3) metrics, (4) capacity development and technology transfer, and (5) education and awareness.

1. The branch on **mitigation** is designed with the objective of making Costa Rica “neutral in carbon emissions” by 2021. Mitigation will be implemented in three

⁹ Based on “Estrategia Nacional de Cambio Climático (ENCC): <http://www.encc.go.cr>”

smaller areas: reduce gas emissions by sources, carbon capture and storage, and carbon markets in the different sectors – energy, transport, agriculture and fishery, industry, solid waste, tourism, water resources and soil usage changes.

2. The branch on **vulnerability and adaptation** will focus on rigorous identification of the vulnerable sectors and the application of adaptation measures to reduce the effects of climate change on the following sectors: hydro, agro-fishing, fishing, health, infrastructure, coastal areas and biodiversity.
3. The area of **metrics** focuses on making the country one which has precise, trustworthy and verifiable measurements and data that contribute to the implementation and follow-through of actions from different points in the strategy.
4. The focal point of **capacity development and technology transfer** has the objective of making the country one with national, regional and local capacity, which enables the operative application of mitigation and adaptation policies for climate change. These include identification and incorporation of technology in these fields.
5. The **education and awareness** branch has the objective of making Costa Rica a country which, by means of public awareness campaigns and education, involves the entire society in the decision-making and execution process related to climate change.

e) **Introduction of C-Neutral seal**

The C-Neutral seal has been branded at the national level with the aim of differentiating the country and the production of goods and services into a verification and certification system, which contributes to the strengthening of competitiveness. The products and services with the C-Neutral seal which will be chosen by the consumer in areas such as tourism, banking, insurance, higher education, and the government who demonstrate a proactive commitment to the environment. The products with a balanced carbon footprint, such as banana, microprocessors, medical devices, and butterfly larvae can reinforce the “Made in Costa Rica” seal to “Made C-Neutral in Costa Rica”.

f) **National strategy for de-carbonization of the economy/ Stimuli for renewable energies**

The country is already working on specific agendas to stimulate the use of renewable energies, which is principally as a result of the rise in oil prices in the past, a situation which threatens to repeat itself. Sixty-six per cent of the energy that Costa Rica consumes is from imported petroleum, and 75 per cent of hydrocarbons are utilized for the transportation of persons and merchandise. Diesel accounts for 44 per cent of the total of the fuel that is most consumed in the country, while gasoline represents 33 per cent¹⁰. The remaining portion is consumed by large companies and industries to generate electricity, among other uses.

¹⁰ Energy Sector Unit - MINAET

In that sense, the national government has promoted the so-called National Strategy for De-carbonization of the Economy, where the use of renewable energy from hydroelectric resources, geothermal, eolic, solar and biomass. The objective is to reduce the dependency on fossil fuels and at the same time promote the electrification of land transportation methods, modernization of vehicular transportation of persons and goods, regionalization of transportation, reinforce the use of multimodal transportation and energy efficiency policies in the industry and general consumption.

One of the measures being implemented by the government, at the request of fuel stations, is the sale of modified gasoline, with low percentages of ethanol. To obtain biofuels, the Government is considering a diverse agricultural basket that is sustainable over time, including the use of a sugar cane and palm oil surplus, and the development of incentives to plant other products such as bitter yucca, sorghum, castor-oil plants, *Jatropha* and others whose production does not compete with food cultivation, as this is a firm and definitive resolution from the government. Additionally, it will create new agricultural zones as these products can be planted where other agricultural products would not thrive, benefitting of a large number of communities and farmers currently with serious limitations of improving their economic and social circumstances.

Diverse rural organizations and companies are developing biofuel programs with which since 2001, they have been carrying out different training activities, intensifying these efforts in the last few years. It is hoped that these initiatives will decrease the dependence on petroleum imports at rising costs, and to protect the environment, given that biofuels cause less pollution.

At the same time, the government, entrepreneurs and various research centers are carrying out relevant studies in order to achieve second generation biofuel production, which also would develop other than biomass material, such as pineapple waste and bagasse, algae and others, which are derived as wastes from agro-industrial processes. Among other measures, the government plans to implement a national campaign on efficient energy management, modify taxes on fuels, and double the tax on the permit for imported luxury vehicles that use diesel, while stimulating an extension of a tax break on more fuel- efficient, hybrid and electric vehicles, and will limit the importation of vehicles over 5 years old. There is also a restriction on vehicle circulation through downtown San Jose, according to the license plate numbers, and an Electric Metropolitan Train system under development.

2.2.2 Green response to the current economic crisis

In response to the current international crisis, the Government of Costa Rica announced a plan for social protection and economic stimulus known as the Protection Plan on 29 January 2009. Specific measures were adopted in the areas of housing, education, non- contributively systems for the Costa Rican Social Security and others, with the aim of providing protection for families in the wake of the crisis.

At the same time, the government put in place measures for worker's protection, such as a scholarship program for the National Learning Institute (*Instituto Nacional de Aprendizaje*) to train workers affected by the crisis. The

Development Bank Law reduced interest rates from State-run banks and provided financial support to companies that have had difficulty accessing credit through the traditional banking sector. The government has also aimed to strengthen the national financial system, principally through capitalization of State-run banks.

There were no specific “greening components” presented in the stimulus package in response to the crisis.

2.3 The skills development strategy in response to greening

The government has been organizing forums, seminars and conferences throughout the country on the aforementioned issues, and has been able to count on the participation of renowned national and international experts, many of them university scientists. These conferences are aimed at all relevant stakeholders in order to inform and involve them of the latest developments in these areas.

Different Costa Rican laws, e.g., the Organic Environmental Act and the Biodiversity Act, explicitly incorporate environmental education for all citizens at every level of schooling. Other standards include Principle 19 of the Stockholm Declaration and a large number of regional codes backed by Costa Rica, aimed at creating regional strategies related to natural resource management. One of the five mainstays of the Regional Climate Change Strategy comprises of education by creating individual awareness and developing public sensitization to enhance understanding and knowledge of both nature and the impact of climate change at every segment of society, as well as the role each of these segments must play in mitigating, adapting, and reducing vulnerability.

In addition to this strategy, the education component is reflected in the Regional Agro-Environmental and Health Strategy (ERAS) 2009-2024; the Central American Sustainable Energy Strategy 2020; the Central American Water Management Strategy (ECAGIRH) 2010-2020 together with its Action Plan (PACAGIRH - El Plan Centroamericano de Gestión Integrada de los Recursos Hídricos) 2010-2012; the Central American Environmental Plan 2010-2014; the Regional Integrated Risk Management Strategy (PCGIR) and the Multi-Year SICA 2010-2012 Program.

Costa Rica’s Organic Environmental Act No. 7554 clearly states, “the central government, local governments, and public and private organizations will encourage permanent inclusion of environmental issues in formal and informal education at every level. The goal of this will be to adopt an environmental culture leading to sustainable development.”

Costa Rica’s National Climate Change Strategy proposes citizen involvement in climate change decision-making and implementation, through instruction and public sensitization. This proposal is in line with the goal of education, which is to develop an analytical attitude in relation to the environment, creating awareness of the interrelationship between personal and collective success and the preservation of biodiversity (as defined in Article 7, subsection 2 of Costa Rica’s Biodiversity Act No. 7788.)

Since climate change threatens every individual and every activity on earth, this strategy is aimed at every resident and visitor of Costa Rica, since each can take concrete actions in order to minimize the sources of global warming.

Insights from education and communication experts provide guidelines for action by different organizations to deal with global warming impacts and opportunities in creative, bold ways. These include:

- The need to raise awareness regarding the interrelationship between people as part of the environment and the dependence of development on the preservation of biodiversity, to internalize individual, organizational, and company responsibility for the current status of their common home, i.e., planet Earth.
- An in depth understanding of the difference between sustainable development and economic growth as the foundation to create a culture based on protecting the environment.
- Making continuous learning possible so that each individual has a better knowledge about the environment.
- Support of current endeavors by creating alliances, not minimizing efforts, and preventing resource waste.
- Climate change is both a matter of attitude and competence requiring constant evaluation of personal, collective, and organizational action proposed, even those thought to solve issues.
- Evaluation of opportunity cost as well as the interrelationships between man and the environment.

Even though Costa Rica's National Climate Change Strategy incorporates the environment as a key topic, it is important to note:

- i) Costa Rica's National Climate Change Strategy aims at environmental policy, not the market;
- ii) it recognizes the need for education at every level and highlights progress in incorporating environmental topics into formal education, chiefly at elementary and high-school level;
- iii) it has promoted specific environmental university curricula as well as CSR programs at different levels;
- iv) it agrees with the effectiveness of some methodological tools used in the past but
- v) it does not specifically indicate capabilities to be created in the population.

Costa Rica's Public Education Ministry developed in 2004 a Strategic Framework for Environmental Education at the first and second basic education cycles, as follows:

- TOPIC: *Institutional Environmental Management*: Designing institutional environmental management processes involving decision-makers and those implementing the decisions made.

- TOPIC: *Teacher Education*: Developing training, updating, and continuous education programs for management and teaching staff including environmental components in education. This training would be developed by experts hired by the government of the major universities. One such teacher education program is spearheaded by the Peace with Nature Initiative, to be further explained in Section 3.2.4
- TOPIC: *Environmental Education Projects*: Developing environmental education projects and taking action at school level, together with civil society players, to strengthen environmental and human values.
- TOPIC: *Sustainable Development Culture*: Fostering educational action to create a sustainable development culture.

In the case of technical, professional, and college-level education, several programs from different organizations as well as from public and private universities exist to deal with the environment and sustainable development. These cover environmental management and impact evaluation, protected area management, sustainable local development, waste management, water, coast, and basin management, sustainable agricultural development, soil and risk, climate change and disaster management, tourism; legislation, ethics, policies, and leadership, and forests and lumbering, among others. These programs began in the 1990s from the global concerns established in the Earth Summit in Rio de Janeiro 1992.

Costa Rica has some 56 universities and 74 vocational schools (including the Instituto Nacional de Aprendizaje). However, only 25 of these offer educational programs related to natural resource management. These include all four government-owned universities (ITCR, UCR (University of Costa Rica); UNA (Universidad Nacional); and UNED (Universidad Nacional Estatal a Distancia), the Instituto Nacional de Aprendizaje (INA) and private schools including a strong component of natural resources. Among the latter, the most relevant ones include INCAE, CATIE, EARTH, ICAP (Instituto Centroamericano de Administración Pública), and the University for Peace, and FLACSO (Facultad Latinoamericana de Ciencias Sociales).

There are some 166 educational programs including 32 bachelor programs, 38 independent courses, 12 associate degrees, ten Ph.D. degrees, one major, 25 licentiate degrees, 35 Masters' degrees, five other graduate degrees, one teacher degree, and four technical programs. As can be seen, most programs are linked to higher and graduate education, with very few technical programs and independent courses.

While education on specific topics regarding management of particular natural and environmental resources covers a large portion of curricula, the contents are increasingly including more general topics to reinforce the students' ability to perform in a green economy. Thus, programs are ever more including the following subjects:

- (a) financial criteria as decision-making elements;
- (b) organization and planning;
- (c) political, legal, and ethical aspects of sustainable development;

- (d) coherence between public policy and sustainable development;
- (e) gender issues in natural resource management;
- (f) environmental quality management;
- (g) role of the private sector in environmental management;
- (h) carbon-neutral strategies;
- (i) corporate social responsibility (CSR);
- (j) not-for-profit leadership abilities;
- (k) analysis of investment projects taking into consideration the environmental perspective;
- (l) entrepreneurialism, innovation, and environment;
- (m) system dynamics;
- (n) social networks;
- (o) statistics and data analysis;
- (p) negotiation and mediation in environmental intervention;
- (q) use of new technologies;
- (r) integrated resource management;
- (s) community participation in natural resource management;
- (t) management decisions and communication;
- (u) political analysis;
- (v) macro analysis of business climate and value change in relation to environmental topics;
- (w) project development and evaluation, and
- (x) fundraising for sustainable development.

There is a central-government strategy aimed at guiding the efforts to mitigate and adapt to climate change, with education as one of its five key mainstays. This strategy involves coordination between public sector agencies with the leading organization as well as among themselves and coordination among private companies and organizations to engage in the change required.

However, Costa Rica's National Climate Change Strategy so far only provides general principles to be considered at educational level, mainly a stress on taking advantage of the country's infrastructure and experience over the last few decades in relation to protecting and taking advantage of the sustainable use of natural resources.

From a curriculum standpoint, no statement exists regarding specific educational requirements to be met at every level in the country or how this will be achieved. Basic education, however, includes instruction regarding environmental topics as a key portion of curricula, stressing general subject such as the sciences, geography, history and civic education.

In relation to vocational schools, just a handful of schools and programs relate to environmental topics. Universities and technological colleges, on the other hand, offer a wide array of courses and associate and teacher degrees.

Programs at both public and private universities are in line with government guidelines in relation to considering national policies of protection, management, and sustainable use of natural and environmental resources. However, the offer of careers at this level has been guided by a strategy aimed at meeting market demand in terms of professionals at some given levels, rather than a specific policy response of incentives leading to an increased academic focus on specific areas.

Government-owned universities are coordinated through the National Rector Council (CONARE), made up of university rectors and vice-rectors' commissions and sub-commissions. The Inter-University Environmental Education Commission (CIEA) is a sub-commission of the Vice-Rectors' Research Commission. For nearly 15 years now, CIEA has worked to incorporate the environment into university activities. Its goal is to enhance the incorporation of environmental education and of the environment itself in the activities of Costa Rica's government-owned universities.

In more than one occasion CIEA has helped create environmental policies and courses of action at a national level, reaching large population segments. For instance, back in the 90s it joined the National Commission for Environmental Education as the representative of universities. Later on, it supported endeavors aimed at implementing the Strategic Plan for Environmental Education of Costa Rica's Ministry of Public Education. In line with the Latin American Plan for Environmental Education (PLACEA), CIEA is currently a member of the Costa Rican team in charge of developing the country's National Plan for Environmental Education (PLANEA), whose goal is collecting success stories and creating a master plan for the next ten years.

CIEA has worked on:

- Designing university environmental policies.
- Developing curricula for different fields including an environmental perspective.
- Proposing specific educational action to be implemented in courses as well as in different methodologies developed by faculty from various fields of knowledge, in order to include environmental issues in university curricula.
- Conducting research to include environmental issues in every field of knowledge.
- Proposing action aimed at communities to change inappropriate environmental behavior.
- Proposing different environment-friendly college mechanisms and management processes.

In doing so, CIEA has:

- Consulting with university faculty members and departments regarding theoretical and methodological perspectives it developed.

- Offering workshops to create curriculum alternatives comprising environmental issues.
- Conducting curriculum research to include environmental issues.
- Advising students on graduation projects/ theses.

As for private education, the National Higher-Education Council (CONESUP) regulates the operation of private universities in Costa Rica. Due to their International Mission status, INCAE, CATIE, and EARTH are excluded. No initiative similar to CIEA exists, however, to include environmental issues in university curricula. Again, the key factors in university offer are the market and the strength of these organizations¹¹.

There is some coordination of skill development policies in Costa Rica in the context of a green economy. First, inter-ministry coordination exists, chiefly between the leading organization, the Ministry of Energy, Environment, and Telecommunication (MINAET) and the Ministry of Education. However, coordination mechanisms with other public-sector organizations, as well as with private-sector organizations represented by business chambers, are being developed through the Peace with Nature Initiative.

No comprehensive information system exists so far to provide data on Costa Rica's labour market in relation to natural resource management. The National Rector Council keeps statistical data of graduates from both public and private universities in the field of natural resources. A large number of relevant careers, however, are not included in this record.

There is currently no established coordination mechanism between the academia as a whole and public and private business sectors facilitating easier adaptation to curricula related to natural resource and environmental management. The most representative case is coordination of government-owned universities. However, the projects from the Peace with Nature Initiative of Costa Rica's National Climate Change Strategy must still be implemented.

3. Anticipation and provision of skills

3.1 Green structural change and (re)training needs

3.1.1 Green restructuring and its impact on the labour market

During the last decades, most of the efforts to establish protected wildlife areas were carried out by the government. Recently, however, the environmental

¹¹ Initial base of careers offered in Costa Rica <http://www.carreras.co.cr/> research was done on their contents in each of the universities. These data revealed that 40 per cent of programs offered institutions belong to government (including the 4 public universities in CR and INA). The rest is private. What happens is that few universities are the focus of increased demand. Only CATIE, EARTH, the UCI and the University for Peace for 37 per cent of programs offered and 60 per cent of the private offering. CATIE is the institute has more supply.

approach is mainly promoted by private initiatives supported and led by the government active regulation.

Important changes have occurred in legislation during the 1990s,¹² which had impacted the country's green economic history. This section combines previously presented information regarding the origin of the Ministerio del Ambiente y Energía (MINAE, currently MINAET), and most of its specialized agencies (Tribunal Ambiental Administrativo, Secretaria Técnica Nacional del Ambiente (SETENA); Sistema Nacional de Áreas de Conservación (SINAC); Oficina Nacional de Cambio Climático, Comisión Nacional para la Gestión de la Biodiversidad (CONAGEBIO); Fondo Nacional de Financiamiento Forestal (FONAFIFO); etc.) and the establishment of certain programs such as Bandera Azul Ecológica, etc.

The country's efforts have led to an intense participation of the environmental NGO sector in the following fields: productive use of natural resources; waste and pollution; support to government institutions through consultancy; and research technicians. This trend has impacted the labour market positively.

Focus groups results demonstrated that the private sector is strongly influenced by government environmental policy changes. Currently there is an incipient market for "green" products, but more and more consumers are able to distinguish conventional products from their greener counterparts. More seals and certifications for products that are organic, Fair Trade, Rainforest Alliance, etc. are emerging.

Focus groups participants indicate that Costa Rica is just emerging in the greening discussion. Participants pointed out:

"We have an environmental culture – people do not think about the consequences of their lifestyles, shopping and so on. So it takes more training to change the culture. Both consumers and industries have to change. For example, companies should adopt social-environmental responsibility or CSR. There are some companies that are changing and developing private strategies".

Diverse opinions became evident when participants were asked about who should lead the efforts in the transition towards a green economy. Some members indicated that the government should be at the forefront. Others consider that consumer needs should be the driving force, while others put emphasis on the proactive role of the universities as a proposal-makers. The government is certainly taking important steps and some private companies and NGO's are moving forward into this new direction. Nonetheless, there are still a deficient number of actors participating on this challenge.

¹² The Forestry Law (N.7575 published in April 1996, encompasses the topic of Environmental Services Payment), Wildlife Law (N.7317 published in December 1992), Biodiversity Law (N.7788 published in May 1998), Organic Environmental Law (N.7554 published in November 1995), Rational Use of Energy Law (N.7447 published in November 1994), Use and Soil Conservation Law (N.7779 published in May 1998).

Sectors with the highest growth potential

In order to identify the sectors with the highest growth potential, studies on Costa Rica's economic activity by branch was considered. Statistics from the Household Multipurpose Survey were taken into consideration.¹³

Data from 2001 is presented. Census data was obtained by INEC (National Institute of Statistics and Census of Costa Rica - *Instituto Nacional de Estadísticas y Censos*) following several methodological changes. From this standpoint, data in absolute values from 2000 and onwards is not comparable to previous years. Annex B shows the percentage of relative share of each branch of economic activity in the total of employees for the period 2001-2008. Trade and repairs shares the largest participation, followed by industry and agriculture. Construction sector participation remains close to 8 per cent; while social services such as teaching and health and social services values are nearly 9 per cent. Table 1 shows trends in employment by branch of economic activity:

Table 1. Trendline Slope
(in conjunction with Graph "Share of employment by industry" presented in Annex B)

Economic activity	Trendline slope (%)
Households with domestic	28.45
Transport, storage and telecommunications	23.21
Construction	15.36
Financial intermediation	9.64
Real estate and business	5.60
Trade and repair	1.79
Public administration	1.67
Education	1.43
Mines and Quarries	0.71
Activities not adequately	(0.60)
Extraterritorial Organizations	(0.71)
Community and personal services	(0.83)
Electricity, gas and water	(1.55)
Hotels and restaurants	(1.67)
Fishing	(2.26)
Health and social care	(2.26)
Manufacturing Industry	(33.21)
Agriculture and livestock	(44.76)

Note: Number in parentheses means negative slope.

Source: Elaborated by the author. Annex B presents a graph of trends by economic activity according to their relative share of labour absorption. Trend lines indicate which activities are growing and which ones are declining.

¹³ Prepared and published based on INEC data: <http://www.inec.go.cr>

Factors responsible for these trends are:

- Activities showing an increased trend during 2001-2008 are "domestic services" then "transport, storage and communication", "services or financial institutions" and the "real estate and business activities";
- Activities slightly increased are "trade and repairs", "public administration" and "teaching";
- Activities slightly decreased are "electricity, gas and water", "hotels and restaurants", "fishing" and "health and social care";
- Activities with a sharp decreasing trend are "manufacturing" and "agriculture and livestock".

As specified by Annex B data, overall trend shows the prevalence of service sectors or "outsourcing". Careers associated with these growing industries, having a high relative participation over time, would promise greater potential.

Tourism deserves special consideration. This sector comprises more than hotels and restaurants,¹⁴ as presented in Table 1.

Costa Rica has a significant tourist potential and has been ranked globally as one of the most visited international destinations.¹⁵ One of Costa Rica's main sources of income is tourism. Costa Rica is a democratic and peaceful country, and it has not had an army since 1949. Although the country is small and it covers only 0.03 per cent of the surface of the globe, it proudly shelters a 6 per cent of the existing biodiversity of the planet. Nearly 25.58 per cent of its territory is composed of conservation and natural protected areas.

The development of different forms of tourism: ecotourism, rural tourism, community tourism, adventure tourism, etc., have enhanced, directly and indirectly, the number of jobs in the country, and both rural protected and non-protected areas have benefitted.

The rapid expansion of the tourism sector is credited with the major infrastructure changes that Costa Rica's economy has experienced since late 1980s. Within the productive activities that stand to benefit by trade liberalization and incentive policies, tourism stands out as the best performer. In 1986, around 260,840 tourists visited Costa Rica, while in 2007 this number increased to 1,979,789. The average growth rate in international tourism arrivals for this period is 10.33 per cent per year (Estado de la Nación, XV Report, 2009).

About 40 per cent of foreign tourists visit at least one state protected forest area (Estado de la Nación, XV Report, 2009). The above figure does not take into consideration the large number and variety of resorts and tourism activities offered by private companies using nature to their advantage. Some of these activities

¹⁴ Also includes: activities of travel agencies, museums, activities and preservation of historic buildings, activities of zoos, botanical gardens and national parks.

¹⁵ For the years 2005-2007, according to the World Tourism Organization, the arrival of tourists to Costa Rica has been the highest in Central America, occupying position 10 in America.

include tours, hikes, riding, sailing, hot springs, beaches, cable cars, gliders, etc., which are not always within protected areas.

Areas adversely affected by the green change

Partial declining of economic activities such as agriculture, farming, and fishing is attributed to the high implicit component of environmental degradation. The expansion of agriculture and livestock production intensifies the use of natural resources and accelerates the process of deforestation and land degradation.

In the 1960s, a series of changes in the economic structure and national agricultural policies accelerated the process of deforestation. These processes reached their maximum impact in the mid 1980s, when the country lost 41 per cent of its forests.¹⁶ The cause of rapid deforestation between 1960 and 1986 is associated with a population increase, expansion of the agricultural frontier and especially with the incentives for cattle ranching for beef exports (Calvo, 2009).

As stated in XV Report of the Estado de la Nación (2009), the main consequence of agriculture on the environment is the contamination of water supply, especially chemical, due to the excessive use of pesticides in agricultural activities such as monoculture, as which pineapple farming is prime example. Nearly 3,000 different types of pesticides are utilized in agriculture related activities. According to the report, state agencies do not have sufficient information and lack the necessary skills to reduce the impact of agriculture on ecosystems and human health.

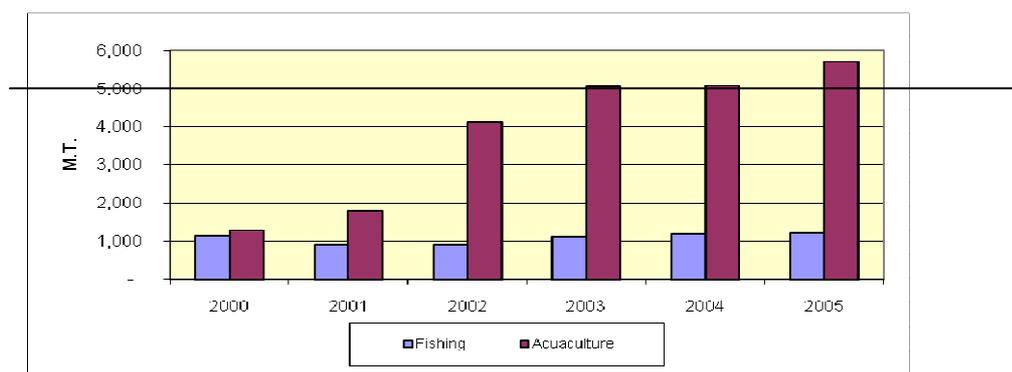
The expansion of livestock between 1960 and 1986 was halted for two main reasons: the decline of meat prices and advances in forestry programs and conservation of natural resources (Environmental Services Payment, for example).

Regarding the fishing industry, "between 1997 and 2006, the uncontrolled exploitation caused a 51 per cent decrease in farming of white shrimp" and "fish such as snapper, sea bass, grouper, snook, jacks and mackerel are extremely affected" (Estado de la Nación, 2009).

Since the year 2000, the use of the dragging technique by shrimp fishermen has remained constant, despite its negative effects on the environment. On the other hand, a less predatory environmental technology, shrimp aquaculture has shown an increase in order to meet the growth of domestic and external demand.

¹⁶ Estado de la Nación (XV report) presents the results of the nation's forest cover changes at provincial and national levels. Losses exchange rates nationwide were 35,000 ha/year during 1960-79, 39,000 ha/year during 1979-86. Recovery rates were 17,000 ha/year for the period 1986-2000 and 26,000 ha/year for 2000-2005.

Graph 4. Shrimp production in Costa Rica, fishing or aquaculture (metric tons)



Source: Aquaculture Department, INCOPECA, 2006.

The manufacturing sector also showed a decrease in production. Costa Rica had a significant decrease on its exports during the period of the analysis. The industry was mainly affected by a lower demand of electronic components produced by Componentes INTEL de Costa Rica. In general, the trend shows a decrease on demanded products by the United States, mainly the market for clothing and accessories produced in Costa Rica.

The above figures and data do not include the impact of the current economic crisis, which was characterized by the breakdown of domestic production, which affects nearly all economic activities, but particularly the construction industry (including free zones), agriculture and tourism. The crisis began in the second half of 2008.¹⁷

Green component of careers associated with successful sectors

According to the focus groups participants, climate change related careers were associated with the greatest potential for the development of green jobs. Certain economic sectors are focused on mitigating climate change by reducing the emission of greenhouse gases. Main industries are energy, construction, manufacturing, transportation, agriculture and forestry. However, the development of this potential relies on the contributions of many other sectors, which include those associated with resources and intensive energy such as mining, information technology and transportation.

Careers with the greatest potential for green jobs in Costa Rica are listed below:

- Administration (new challenges in business, recycling, energy conservation, membership green certificates and markets, etc.)
- Agribusiness (seeking sustainable agriculture)
- Architecture / Construction (same reasons than engineering)

¹⁷ It is expected by these authors that the economic crisis will increase unemployment in sectors such as formal commerce, manufacturing, assembly and textiles, financial services, tourism and some agricultural products. These economic sectors export mainly to the United States.

- Banking / Ecobanking (related to green projects)
- Biotechnology
- Communications, media
- Educators (must have environmental awareness to prepare people in the new green jobs) (Section 3.2)
- Energy, including the production of solar panels
- Engineering (design of new projects containing green elements)
- Food technology
- Forestry and wood products
- Health with environmental specialization
- MBA with CSR (all companies tend to include CSR)
- Product Design (same reasons than engineering)
- Technology
- Tourism (eco-tourism)
- Transportation
- Waste management – recycling

Green issues should be included at all levels of the education system. Universities must take charge of the specialization of professionals.

3.1.2 Identification of (re)training needs

Costa Rica's educational indicators are related to coverage and material requirements. Conducted studies do not take into account quality of education nor labour market deficiencies. The Instituto Nacional de Aprendizaje (INA) identifies massive needs in order to meet economic sector requirements.

INA's main attributions are the design and execution of training programs in accordance to other public and private institutions; establish didactic enterprises and other formation centers, offer technical assistance to institutions and companies for the creation and functioning of professional training, among others (Article 3, INA's Organic Law, No. 6868, 6 May 1983).

The government develops education policies under the Ministry of Public Education (MEP in Spanish). The General Direction of Formal Education shall be a Supreme Council composed as stipulated by law and chaired by the Minister. Article 9 of the Basic Education Act N. 1957 states: "The Board of Higher Education authorized curricula and teaching programs for different levels and types of education. These plans and programs will be flexible and vary according to the conditions and directed the country's needs and progress of the science education and will be periodically reviewed by the Board. They shall be designed and implemented taking the following into consideration:

- a) Correlations necessary to ensure the unity and continuity of the teaching process;
- b) Psycho-biological needs and social interests of students.

MEP's approach is focused on the learner and the progress of science in accordance to the labour market needs. From this perspective INA takes action, as the most important institution in re-training, including green jobs.

Universities also play an important role identifying training needs. The National Council of University Deans (CONARE in Spanish) coordinates country's or public university higher education. The Superior Education Planning Office (OPES) is the technical and advisory party. Both bodies were established under the Convention of Coordinating of Higher Public Education in Costa Rica on 4 December 1974. Deans of the Universidad de Costa Rica, the Instituto Tecnológico de Costa Rica, the Universidad Nacional and the Universidad Estatal a Distancia make up CONARE.

Public universities have special autonomy guaranteed by the Constitution. Article 84 of the Constitution not only gives administrative autonomy, functional and financial aid to public universities, but it also gives them full capacity to decide its own organization and government."¹⁸ Therefore, the government intervention is minimal, allowing the universities to operate under their own standards.

Several positive consequences may result from public and private institutions addressing green jobs and related-investment properly. An increase in energy efficiency within the buildings and public transportation; energy efficient electric appliances and vehicles utilization; renewable energy use (wind, solar, geothermal and biomass), an intelligent electric wire operation and the rehabilitation of rivers, forests and basins will be some of the most relevant results.

The lack of institutional capacity and insufficient skills for decision making in the environmental sector has been associated with deficiencies in the implementation of policies and coherent strategies to improve the continuing degradation of natural resources.

Other signs of retraining needs are:

- Reduced number of institutions, short-term thinking and a partially competitive situation between institutions;
- Scarce outreach of the Alumni and their professional associations;
- Society's lack of awareness about the responsibility of professionals and low self-esteem or self-confidence;
- Lack of means and channels to express professional's standpoints and opinions in order to influence society's political decisions;
- Institutions training on current themes without a multidisciplinary approach.

Many companies have promoted their internal change towards sustainability, either to meet new requirements for their products or to seize the country's image and position in a green market. In some cases, it has been necessary to hire new

¹⁸ Asociacion Nacional de Empleados Publicos (National Association of Public Sector Employees) "Resolucion del TSE Sobre Autonomia Universitaria" available at <http://anep.or.cr/leer.php/1739>

staff. Most of the companies have re-trained their employees to adopt the newly implemented green programs.

The case studies below describe the greening process in different companies and institutions. However, it is evident from the analysis that all employees are required to understand and implement environmental programs that are developed or brought into the company. Each certification or environmental requirement, to which the company subscribes, requires a different procedure to perform those activities. Employees must be able to meet these new measures.

Tourism's negative impacts have also brought about re-training needs. In general, adverse impacts attributed to tourism are solid waste management, environmental pollution, overuse of water, energetic waste, and others.

As mentioned previously, the decline of agriculture is a major issue in the country. Companies in this sector have had to re-invent mechanisms and procedures to remain competitive. Dole, for example, has been challenged to lead environmental actions towards greener fruit production. The company has created new green collar jobs and is re-training their staff. Also, to ensure their stability within the market, other companies such as COESA (Eastern Operating Consortium SA) and Purdy Motor are re-training their staff.

Leading companies have followed a similar pattern to establish their new environmental strategies. First, the company defines green changes, goals or targets for their product, service or productive process. This is the result of their adherence to certification programs such as ISO or C-neutral initiatives; a market opportunity to win a premium or simply adjustments to comply with legislation.

Second, a professional must be hired to implement changes and perform technical studies. This person is also in charge of promoting an environmental cultural change within the company.

Some guidelines to identify national and regional re-training needs in the country were developed during the focus groups sessions:

- **Pre-school and school:** habits for environmental caring should be inculcated (waste disposition, water and energy savings, protection of wildlife areas)
- **University:** courses regarding natural resources and the environment should be introduced as a requirement for all careers (conservation, biology, ecology, environmental legislation, environmental damage, sustainable development, climate change, pollution). Also these institutions should develop curricula on sustainability.
- Participants also reinforced the promotion of adult education to increase interests in further education and/or training. Communities can be reached through media in order to promote private companies initiatives (Teletica Canal 7 campaign on recycling and the National Power and Light Company- CNFL- to plant trees). This strategy requires a comprehensive knowledge of media. Journalists must have a minimum acceptable knowledge of environmental issues and must utilize related jargon.
- Engineers often lack the ability to analyze the "cost-benefit" ratio of human related activities and their impact on the environment. It is necessary to

strengthen this area to improve engineer's participation within sustainability issues. The LEED (Leadership in Energy and Environmental Design) certification for engineers is one avenue for promoting this change.

- Professionals in finance must also learn about environmental management and energy policies in order to incorporate related variables into financial flows. Finance, engineering and environment fields present great affinity. MBA degrees must include green components in their curricula, especially business sustainability. Moreover, engineering and agronomy students must learn to maximize power efficiency and entrepreneurship.
- A majority of participants in the focus groups pointed out that currently most professions require leadership, communication, negotiation and teamwork skills. This is particularly relevant concerning new green jobs such as: environmental coordinators, environmental managers, CSR directors (INCAE Business School, C-Neutral and Dole cases). Focus groups participants also identified that colleges should specialize in technical careers related to natural resources and environmental management. Vocational schools should include resource management courses and provide required skills for young people who are willing to access the SME (small and medium sized enterprises) labour market.

Annex C includes a list of the skills with highest demand in the labour market according to a study published by the national newspaper, *La Nación*, in 2007 (Cabrera, 2008). Research was conducted for the general market with no focus on green jobs.

3.1.3 Skills response

Public education is free and compulsory¹⁹ in Costa Rica. There are more than 9,300 educational institutions. Costa Rica's educational system is ranked No. 32 worldwide, according to the Global Competitiveness Report 2008-2009 from the World Economic Forum (WEF, 2009).

There are over 200 private schools registered in the Ministry of Education, most are bilingual (English, German, French and Hebrew) and offer world-renowned programs such as Advanced Level (Advanced Placement – AP) and the International Baccalaureate (International Baccalaureate – IB).

There are also schools and colleges with international certification. In 2009, seven schools provided international diplomas certified by organizations such as SACS (Southern Association of Schools), NEASC and MSA. These institutions include: American International School, Blue Valley School, British School, Country Day School, Lincoln School, Marian Baker School and Pan-American School.

Focus groups participants were motivated to discuss the educational system role in responding to new skills requirements. Members agreed that Costa Rica has sufficient educational institutions. In spite of this, the system requires structure and teaching methodology changes.

¹⁹ Under the Constitution, primary and secondary education is free and compulsory. Students are guaranteed free education through High School.

Data from Costa Rican Investment Promotion Agency (CINDE in Spanish)²⁰ shows that since three years ago, Costa Rica has had a tremendous demand for bilingual call center staff. Currently there are six large companies rendering this service and employing close to three thousand people.

English language was identified as a critical skill for both general and green jobs. It is a must-have in tourism, export industries, banking and telecommunications. Communication with environmental certification entities, customers overseas and technology providers is mostly done in English.

MEP, INA, CONARE, CINDE and the National Competitiveness Program of the Ministry of Foreign Trade launched a multilingual program in 2008. The aim of this initiative was to improve English proficiency among Costa Ricans in order to heighten their personal development and to gain access to better employment opportunities.

Within the first year of implementation, the program reached 3,750 students. Also, approximately 1,830 people distributed in 119 groups received English training as part of the Plan to Strengthen English Teaching from the Costa Rica Multilingual Initiative. INA graduated 4,785 students in 2009 compared to 380 in 2006. This is an outstanding accomplishment for the institution.

In addition, other entities have recognized their role to strengthen the skills demanded by green changes:

- The Chamber of Industries of Costa Rica provides courses and training for the industry;
- The Venture Program of the Government of Costa Rica. This program emerged as an initiative started by President Arias Sanchez in order to facilitate the enrolment of students in the education system. The program provides scholarships that reward students' performance. In 2007, 132,000 students were awarded scholarships and 17,000 were able to graduate from school. In 2008, the figure increased to 150,000. If these students remain in the formal education system, they may be trained to acquire skills in new work opportunities, including the green jobs.
- The National Training Institute (INA) offers Call Center Operator and Plant Operator –Environmental Management²¹– courses. The institution is working closely with the Health Minister and private companies to offer more tailored courses. INA will be incorporating environmental management as a transversal topic on its courses.

In order to achieve a functional response to re-training needs, focus groups participants highlighted the challenges presented below:

²⁰ CINDE is a private, non-profit and apolitical organization. During its 25 years, CINDE has attracted more than 200 companies to Costa Rica. <http://www.cinde.org>

²¹ INA (2009). INA is the main institution providing public training in order to meet the labour market needs. INA enrolled a total of 286,225 people in 2008, from this data, 157,384 were women. Technical programs have graduated 24,908 people. INA has absorbed the crisis impacts on displaced people offering a fellowship program to train 5,000 workers.

- Create consumer awareness. There is an increasing need to educate consumers in their shopping habits. In general, it is required to improve the environmental citizens awareness;
- Doing business in Costa Rica is hindered by excessive bureaucracy. Compliance with standards restrains innovation. Also, the public sector agencies often lack the capacity, skills and knowledge to manage these areas;
- A power generation monopoly holds back innovative entrepreneurs and opportunities;
- Private sector focus group participants noted that only a small pool of consultants are specialized in “green” fields;
- The formal education system does not incorporate the green component broadly in traditional careers and majors. There is a gap between formal education and skills required by the private sector;
- Governmental institutions conduct research and development while carefully protecting intellectual property rights;
- Waste collection centers are deficient in appropriate infrastructure. Population must be trained in order to recycle and dispose waste properly.
- Municipalities along the country have insufficient trained professionals in natural resources management. Commonly hired employees without experience in environmental issues execute poorly in planning and management;
- Private companies are deficient establishing an accurate profile for new jobs posting;
- Assistance and technology transfer is limited in most of the fields;
- Inefficient resources management –water, energy, forest, water– is evident in the companies’ profitability.

Finally, in order to determine the response of the university education system, the Latin American Center for Competitiveness and Sustainable Development (CLACDS) at INCAE Business School conducted a survey in 2009 of all programs offered by registered higher education institutions. All green jobs were classified by grade, as follows:

1. Masters, undergraduate and postgraduate;
2. Doctorates;
3. Baccalaureate, Diploma, Teachers, Technicians and Specializations; and
4. Free courses.

A detailed list is presented in Annex D.

Table 2. Distribution of green programs offered by higher education institutions in Costa Rica, 2009

Grade	%	Public or Private	%
Master's, undergraduate and postgraduate	35.6	Public Institutes Programs	39.3
Doctorates	6.1	Private Institutes Programs	60.7
Baccalaureate, Diploma, teachers, technicians and specializations	30.7		
Free courses	22.7		
Blank	4.9		
Total	100.0	Total	100.0

Source: Elaborated by the authors. See Annex D for more details.

Private institutions offer most green jobs. Most degrees offered are short postgraduates (two years or less) and technical careers. Free intensive courses, lasting approximately one to two weeks, are given by a wide variety of institutions.

3.1.4 Case studies

Case Study 1. Steps towards carbon neutrality²²

Introduction

Costa Rica is currently one of the four leading countries with the goal of becoming carbon neutral by 2021. In order to increase global consciousness regarding climate change and sustainable development, Costa Rica's government created a strategic plan to mitigate CO₂ emissions. In 2007, Costa Rica's President Oscar Arias organized and promoted Peace with Nature Initiative (*Paz con la Naturaleza*), encouraging the nation to align itself to this cause.

This case study includes information on expected and current employment shifts due to the carbon neutrality initiative in the country and analyzes the effects of carbon neutrality on several companies' recruitment policies. Different companies have joined this strategy. It is worth mentioning the leading position of Purdy Motors, exclusive distributors of Toyota in Costa Rica, and COESA, a transportation company located in San José.

Purdy Motors owners analyzed different options to implement environmental changes in their company. They were very interested in supporting government's plans towards Costa Rica's carbon neutrality goal. Also, they were willing to explore the extent of opportunities that would enable the company to become carbon neutral and position itself as the "green leader" in their market. The

²² Based on personal interviews with Eladio Madriz, General Coordinator: Consorcio Operativo del Este S.A. (COESA), on 30 Oct. 2009; with Luis Mastroeni Camacho Communications Manager & RSE, Purdy Motor Group (distributor of the Toyota brand), on 2 Nov. 2009.

company's main objective was to share this vision with their clients in order to assume responsibility for the emissions of commercialized vehicles through an awareness campaign. The strategy was designed to offer customers the opportunity to neutralize emissions in a simple and sustainable manner. An expert consulting group was hired to assist this process, measure the financial impact and identify the potential market. The initiative included creating awareness throughout the entire company and training the staff involved in the carbon neutrality process. It also included recruitment of new employees and training the existing in the whole value chain.

The Eastern Operating Consortium SA (COESA) is a public transportation company providing services on six routes in the eastern sector of the metropolitan area. COESA was as Purdy, similarly inspired by the Costa Rican government initiatives on reducing carbon emissions. It announced its corporate goal to become the first carbon neutral company in the Costa Rican transport sector. Since 2006 the company has been implementing the use of biodiesel in their 133 units at a rate of 30 per cent or B30 biodiesel. COESA has a waste management program (metals, filters, used oil, glass, plastic, paper, cardboard, electronic parts). Additionally, the company owns farms dedicated to conservation, reforestation and cultivation of timber species in order to offset their emissions of CO₂ into the atmosphere.

Purdy Motor S.A. experience

Purdy Motor shares 29 per cent of the automotive market in Costa Rica. This position was obtained mainly due to their excellence in customer service. Purdy Motor Group, since its establishment in 1957, has kept a strong commitment based on respect for people and other core values as their strategy to achieve a responsible and honest business. Also, increasing environmental-friendly business practices has been part of their way for doing business.

Company's transformation was based on the integration of Corporate Social Responsibility (CSR) into the "core" of the organization and set aside other philanthropic actions.

Green jobs label is not yet formally introduced in the company. However, given the fact that environmental awareness is one of the core values of the company, it is a requirement that all candidates subject to interview must be carefully analyzed in their environmental consciousness. Since Purdy seeks service-oriented employees, main required abilities include: customer service, teamwork, listening skills, environmental sensitivity²³ and continuous improvement.

Purdy's administration believes that government and education institutions should encourage people to increase their awareness and knowledge on "green topics", regardless of their profession. The company includes internal training programs for all staff. In 2008, Purdy addressed CSR awareness in their employees. The company is making efforts to train, motivate and engage their

²³ Environmental sensitivity includes the willingness to recycle, avoid water and energy wasting, support environmental campaigns and awareness of major environmental issues (climate change, pollution water resources, the role of forest cover, etc.).

personnel in capacity building. It has created the "Purdy People" culture, a strategy based on case studies of Toyota Group worldwide.

The company also has been awarded with the prize: Best Toyota Dealer in the World due to its excellent customer service in four different occasions. Consolidation and business growth within and outside Costa Rica has been part of people expectations. Their formula to success has been honest work and passion, within a philosophy of continuous improvement and motivation.

Due to the introduction of Toyota Prius, Purdy has trained a small group of people in their Sales and Parts Department to provide assistance to customers who purchase this vehicle. Training was conducted directly by experts from their headquarters located in Japan. Toyota Prius is the only vehicle that uses a technology called Hybrid Synergy Drive (HSD), which intelligently combines a gasoline engine with a highly responsive electric motor. Purdy's vision pretends that consumers increase their awareness of environmental responsible products, which may produce benefits, and added value to their community and environment.

COESA experience

COESA provides service to San Pedro, Sabanilla, San Ramón de Tres Ríos, Ganadilla, Zapote and Curridabat, which represent 58 per cent of the entire eastern sector. This consortium operates 133 units and its labour force comprises 230 people, mostly drivers. Following President Arias' announcement on C-neutral goals, as well as their initiative to have all their projects conducted by sustainable standards (biodiesel, waste management, farm forestry coverage), COESA hired an environmental services technician holding a Bachelor's degree in Environmental Services.

Technician responsibilities include:

- Lead programs to reduce the generation of emissions and solid waste;
- Prevention of risks associated with storage of hazardous materials and water efficiency;
- Implementing strategies for Cleaner Production and Pollution Prevention;
- Ensure adequate environmental performance to support all employees through training;
- Communicate the company's environmental policy to customers, suppliers and public in general.

COESA biodiesel program aims to convert 100 per cent of their vehicles to use 100 per cent biodiesel. This substitute is derived from vegetable oil. For this purpose, a Bio-Energy General Manager was hired. Also the Operations General Manager is in charge of this responsibility at the highest corporate level. Main skills required in these positions include:

- Engineering and mechanical abilities to deal with technology changes;
- Communication skills to participate in the meetings held by the National Biofuels Commission.

The company's experience recruiting personnel for the Bio-Energy Manager position demonstrate that there is enough supply of qualified people in the market. Nonetheless, at the beginning there was a lack of recycling contacts.

Also, the company offered training in waste management, energy savings, healthy habits to other employees like mechanics, assistants and drivers to enhance their environmental programs. These actions have yielded a reduction in their operation costs and also they have received an additional income due recycling.

One interviewee stated that: "Of course there was an impact in our corporate culture. Today the owners are not only thinking about profit but also on how to produce a sustainable operation. Today employees think what can be done with things previously considered as wastes".

Conclusion

The Costa Rican labour market offers well-trained personnel to deal with arising C-neutrality issues. Both corporations represent successful examples of this trend, hiring employees with a strong knowledge in green topics.

In both companies existing personnel was required to receive training in order to achieve and promote their sustainability-oriented goals. Most of the staff was required to change habits and practices regarding the use of energy and waste management. The newly hired environmental manager was in charge of leading the training sessions as part of the strategy needed to accomplish C-neutral goals in both companies.

Case Study 2. PRUGAM and the environmental sustainability of Costa Rica's Greater Metropolitan Area (GMA)²⁴

Introduction

Financing for *Plan Regional Urbano de la Gran Area Metropolitana* (PRUGAM) was approved in December 2003. This plan, supported by Law 8342 (2002), is based on an agreement between Costa Rica's Government and the European Union (EU). The main objective of PRUGAM was "to improve the efficiency of the Central Valley urban system – main Costa Rican economic region – by reducing current environmental, social and economic costs, derived from an irrational and unsustainable land use model".

PRUGAM, currently in its final stage, had three main objectives:

- 1) update the 1982 GMA Plan;
- 2) develop or update the 31 urban plans of the municipalities belonging to the GMA and also develop some metropolitan guidelines; and
- 3) promote urban culture along with the improvement of the local and central urban management.

²⁴ Based on a personal interview conducted with the architect, Eduardo Mata Brenes, PRUGAM Project Director, 28 Oct. 2009.

Costa Rica's GMA is home to 57 per cent of country's population, even though it represents only 4 per cent of land. This region is also responsible for 70 per cent of the National GDP. Previous survey pointed out several challenging elements of the urban central valley: environmental, urban roads and transportation, urban housing, as well as social, economic, legal and institutional systems. There are many strategies, which have been proposed as mechanisms to face these problems.

Environmental issues are related mainly to land-use, protected zones, green and leisure areas, landscapes, borders for the urban and agricultural zones, as well as the identification of hazardous areas. Other worth mentioning issues includes: lost of forest cover due to unplanned demographic growth, waste management and water and air pollution.

In order to achieve the recommendations suggested by PRUGAM, a new professional profile for recruiting personnel at the municipalities has been developed. Also, a new specialized position, which integrates environmental issues in urban planning, has been incorporated.

Background

On 18 December 2002, the Legislative Assembly of Costa Rica adopted the Framework Convention on EU-CR, 1999, through Act No. 8342, ratifying the Framework Convention for Cooperation with the EU. Based on this regulation, a financing agreement – PRUGAM – was signed up a year later.

To date, the following have been the most relevant outputs of this plan:

- 1) A regional urban plan, which covers about 1760 km², 31 municipalities and four central provinces (San José, Heredia, Cartago and Alajuela). The plan calls for seven systems that seek to functionally integrate the territory.
- 2) Design, update and approve the 31 cantonal master plans,
- 3) The execution of various demonstrative works, already built, motivation programs directed to municipal officials and the establishment of GAM Information System (SIGGAM), which brings digital mapping to PRUGAM Plan, derived from the master plans and official mapping, GAM scale of 1:10,000, as well as databases of PRUGAM studies.

To achieve established goals, PRUGAM must assemble a multidisciplinary team. At the management level, the group should be composed of a wide array of professionals including: architects, urban design experts, geographies, the experts in architecture, urbanism, urban design, geography, geographic information systems, sociology, gender issued, administration, journalism, environment, hydrogeology, laws, civil engineering, education and culture, housing, road infrastructure road and public transportation (energy, etc.).

Thirty professionals, of whom 45 per cent are women, integrate the management team. Most professionals involved in PRUGAM are in their thirties. Training integrates the use of high-tech tools and computer systems. Contracted studies have covered topics such as environmental, water, urban, social, economic

production with emphasis on urban, peri-urban, agricultural, legal and institutional mapping of the GMA, among others.

In addition, there are 31 representatives in the municipalities. Training and experience amassed by PRUGAM officials allow the creation of tools, which can be applied and transferred to municipalities in the training process. Also, there is a complementary training plan offered by Technological Institute of Costa Rica.

Challenges and future needs

Conducted interviews demonstrate a lack of resources in the municipalities to implement their constitutional mandates. Also municipalities do not have an instituted culture to promote urban development taking in consideration socio-economic aspects. PRUGAM pretends to incorporate training to enhance this culture in the GMA.

PRUGAM expects that each municipality contemplates in their budget the payment for an interdisciplinary team, similar but more compact than the PRUGAM one. Human resources integrating the team may be committed to sustainability. These new positions will bring employment to approximately 150 persons, taking into consideration a team integrated by 6-7 people in each municipality. Also, this project may expand urban development plans, which can be implemented by private organizations, generating new jobs opportunities in this area.

List of potential professionals required to integrate the multidisciplinary team according to PRUGAM guidelines is presented below:

- a) Professional profiles:
 - Architect specialized in urban planning;
 - Geographer specialized in Geographic Information Systems (GIS);
 - Social worker or sociologist;
 - Lawyer specialized in urban legislation and environmental legislation;
 - Environmental specialist (biologist, forestry engineer, ecologist) with expertise in urban planning.
 - Urban economist
 - Administrator

Most municipalities do not have a multidisciplinary team. This leads to an important gap in their pool of human resources qualified to address urban planning issues.

- b) In addition each team should receive a one-two months training period followed by several days every four months during a year. Training should be regulated by PRUGAM plans²⁵ and should include:

²⁵ Two people interviewed cited two institutions that have the ability to develop training: One is the Technological Institute of Costa Rica (one of the four public universities and the third largest in the country). PRUGAM has been working with this institution, specifically

- Content of Regulatory Plans
- PRUGAM (project objectives and history)
- Regulations (urban and environmental legislations)
- Cartographic Information Management
- Concepts of urban design
- Relationship patents - cadastre
- Municipal administration (regulations, laws)
- Economic, social and environmental information for provinces

In order to succeed, municipalities must recruit the above-mentioned team. Also, the hiring process should ensure that each professional has received training in climate and environmental issues. Professionals must be willing to “green” their current positions by making changes to reduce their carbon footprint, ensure efficiency and become environmental managers.

The labour market

Qualified personnel to integrate PRUGAM teams’ in the municipalities are available in the local labour market. If professionals from other backgrounds are willing to become part of the team, they may take courses in sociology, urban design, and urban economy and therefore complement their expertise. Public universities also offer consultative services. Professionals from the private sector have contributed to the Project Advisory Committee through the monitoring of contracted studies.

Formal education in public and private universities and training institutions are supplying enough professionals and technicians to meet current labour needs in this area. Nonetheless, specific and more complex aspects of sociology, urban design and urban economy require training overseas in countries with a vast experience in those topics. Finally, more emphasis must be placed integrating environmental impacts and awareness as part of universities curricula in order to offer higher quality courses to professionals willing to green their jobs.

Conclusions

According to the interviewed architect, Eduardo Mata Brenes, greening existing jobs will be a fundamental step to accomplish PRUGAM goals. The entire urban-regional model that arises is based on the environment and quality of life for people. This leads to acknowledge the fact that demographics play an important role in urban planning.

"Officials from PRUGAM and its previous stages (Phases I and II of the National Urban Development Plan before 2002) have been emphasizing the need to orient and promote urban development according to environmental criteria, urban and socio-economic backgrounds. The city is not only about

the Housing Research Center, and there is already knowledge created from this relationship. Another institution is the Instituto de Fomento y Asesoría Municipal (IFAM).

where we live, is also part of development and is part of the environment. The best cities in the world have understood and promoted this."

3.2 New and changing skill needs

3.2.1 New green collar occupations

In Costa Rica, as is the case throughout the world, the response to climate change has created the need for new and specific measures across industries and sectors, and requires adequate human resources to carry them out. As such, new green collar occupations continue to emerge in the labour market for sectors that may or may not be directly linked to environmental issues. This shift has led to the creation of new employment opportunities in manufacturing, construction and transportation, for example, while at the same time creating and expanding on opportunities and niches in other traditionally environmental areas such as agriculture, energy, and environmental management. New occupations include Natural Resources Manager/ Coordinator, Corporate Social Responsibility Manager, Environmental Consultant, Energy Efficiency Consultant and others. It must be noted that many new green positions are filled by persons who received conventional training in areas such as Biology or Tourism, however due to the skills needs of the new position are able to transfer current skills and acquire new ones as necessary so as to better carry out their job functions.

New collar jobs in Costa Rica cut across industries, companies and geography. Due to the cluster of industry in the Greater Metropolitan Area there might be a higher concentration of positions, however there are opportunities throughout the country. Interestingly, academia is one of the sectors in which many positions are being developed, particularly by tertiary institutions such as CATIE, INCAE and EARTH to address natural resource management, climate change an energy efficiency issues, in addition to carry out research and development and curriculum development to respond to current and projected needs of the society. EARTH and CATIE for example are located in the rural province of Limon to the east of the capital San Jose. Many of the existing wind farms and areas being scouted for such development are located in the province of Guanacaste, a rural province on the northwestern coast of Costa Rica. Due to Costa Rica's extensive forestry cover as well as the wide array of flora, fauna and other natural features, many eco-tourism activities are located throughout the country. The cases and examples selected for this paper demonstrate that greening changes and job creation are taking place in large, medium and small companies, both local and multinational such as Florex, Dole and the Plaza Herradura (Ramada).

Technology and new green jobs

Technological change and innovation are important for new skills demands. Currently, many of the new innovations such as solar panels or rechargeable flashlights are made outside of Costa Rica and are imported; however, the country is just beginning to make advances in the general area of technology and innovation.

According to the World Economic Forum's Global Competitiveness Index 2009 (WEP 2009), Costa Rica is now ranked 55 of 133 countries, up from 59 in 2008, thanks in part to improvements in innovation evidenced by relatively high

rankings for R&D, alliances between universities and the private sector, availability of engineers, scientists and other relevant professionals in the country, and, finally, a public that is increasingly more interested in differentiated and advanced products.²⁶ This interest in technology and innovation also plays out within the context of the green economy, particularly for small-scale research in the areas of biofuel production using *Jatropha* or algae, re-utilization of vegetable oil from fast food companies for fuel production, waste to energy opportunities and changes in agricultural processes and materials.

Several focus group participants, as well as Dr. Leon (Peace with Nature Initiative) noted that there was much potential for innovation in the renewable energy sector, but that the government monopoly on energy production limited the scope and reach of independent power producers in Costa Rica who wished to pursue opportunities for clean energy production, particularly for eolic energy. Additionally, Dr. Leon noted that the transportation sector would benefit from greater clean technology such as more accessibility to electric cars and electric mass transportation systems, as this is an area in which the government should take leadership.

Role of technological change and innovation

There are several existing occupations and qualifications which can supply the workforce with new green jobs. Persons with extensive training in the sciences, geography, engineering, communications, information technology, education and the services, for example, were considered in the focus groups to have the skills set for new green collar occupations. For example, persons trained as Biologists can take advantage of new opportunities in conservation and natural resource management, or even ecotourism. Others, such as Electrical Engineers, can learn skills to enable them to serve as energy efficiency consultants, designers for solar panels and wind energy turbines, and others with training in marketing and communications can help their companies organize and streamline CSR efforts. Persons trained in environmental law or natural resource management can transfer their skills set and provides services as environmental consultants. Indeed, it was pointed out in several focus groups that the fundamental skills for greening already existed within the economy, but that a deeper knowledge of the issues, processes and innovations were needed carry out greening. This is one specific area in which the academic and training institutions could play a greater role in the skills response, to be discussed in Section 3.2.3.

3.2.2 Greening existing occupations

Many already- existing occupations in Costa Rica are becoming greener. As such, professionals who are already established in their companies are seeing their job profiles change to become increasingly more conscious of the impact on the environment as well as new ways to administer said occupation while lessening the impact. Participants of the focus groups held for the study pointed out on several occasions that many of the greening initiatives are being undertaken by private companies by their own volition, some in response to the government's stated

²⁶“Resultados del Reporte Global de Competitividad 2008-2009”, available at: http://conocimiento.incae.edu/ES/clacds/nuestros-proyectos/archivo-proyectos/proyectos-de-competitividad-clima-de-negocios/WebsiteWEF/index_files/CRRCG2008-2009.pdf

objective to make the country carbon neutral. Given this, many of the occupations which are greening are institution-specific and in line with the vision of the particular organization, regardless of its size or location. Large, multinational companies such as Dole (Costa Rica) and Coca-Cola are taking concrete steps to make their processes, and therefore their job posts greener, as are small and medium enterprises (SMEs) such as Florex (a small company which manufactures cleaning products) located more than half-hour outside of the Grand Metropolitan Area.

The trend being observed (from the focus groups) is that the economic climate is demanding a change to green, and job seekers are therefore either taking their previous knowledge and applying to existing or newly-created green job opportunities. Additionally, focus group participants believed that savvy and environmental consumers in Europe and North America have set the trend in Costa Rica by demanding socially and environmentally responsible products and services, and this had an effect on many industries, including agriculture and tourism. Costa Rican consumers are also becoming increasingly more conscientious, seeking out seals and certifications when making purchases. It is this consumer behaviour that it is believed will encourage more and more private sector entities in particular to change their processes so as to capture this emerging niche of conscientious consumers. The private sector and public sector responses will set in motion a sequence of events, institutional needs, job opportunities, and education/ skills development.

Skills demanded for greening

Skills which seem to be in particular demand include understanding and calculating carbon footprint, energy efficiency measures such as calculating savings, utilization/ change of materials, machine operations and mechanics, electro-mechanics, maintenance, refrigeration, recycling, waste management and development of environmentally-friendly and biodegradable packaging and/or processes, natural resource management, water treatment and purification, clean production, risk management, project financing and feasibility (eco-banking), computer systems management, services, communication, negotiation skills, fluency in a foreign language (particularly English) and many others, given the needs of the particular industry.

As noted by the diversity of skills required to green existing jobs and assist with the creation of a green economy, both blue and white-collar jobs are involved in the change. Blue collar manual labour in areas such as construction or maintenance for example are as instrumental and necessary as those in services or administration, which are traditionally considered white-collar. Additionally, decisions and measures taken at the white collar level may be administered by blue collar personnel, and it is therefore indispensable that training and sensitization to climate change and other related issues is transversal and carried out to benefit different employees across skills and professional levels.

For the creation of a green economy, the focus group participants noted that education was necessary at all levels. Primary education, it was thought, should have environmental issues integrally included in the basic education package. At the same time, secondary and tertiary education (including high schools, vocational schools, training institutes and universities) should all encourage and develop skills

and career paths to green existing occupations or create completely new jobs as needed by the green economy. Additionally, it was emphasized that these studies should be multi-disciplinary, so that someone studying finance could understand and develop basic skills in environmental management and be able to create synergies between the two areas.

As with the traditional economy, qualifications and skills level will vary by job type. A 19 year-old student with a vocational education diploma in mechanics or refrigeration should be able to access a green collar job in the same field. The same is true for a student of the Instituto Nacional de Aprendizaje (INA), which requires that for the majority of its programs, prospective students be between 15 and 20 years- old and possess a basic primary (6th grade) education. Opportunities in tourism are accessible for students with vocational educations, as well as those possessing bachelor's degrees from undergraduate institutions. The University of Tourism (UTUR) lists 'Tourism, Ecology and Sustainable Development' as the primary core course for both the Hotel Administration and Food and Beverage Administration degrees. Additionally, the university offers a degree in Eco-tourism Management, which provides students with a diverse array of skills including identification and observation of flora and fauna, environmental legislation, environmental planning, rural development and marketing.

As noted in Section 3.2.1, technological change and innovation demand that professionals continue to learn new skills to utilize in already existing professions. In many cases, the new skills that are acquired have to be transferred into areas where they were not traditionally utilized before. Florex is a small cleaning company in Costa Rica which began to make its own detergents and products several years ago. The company's president had studied electrical engineering in high school and metallurgy at the university level before working in construction, while the company's vice president was educated as an environmental lawyer. They both decided to implement changes to make their entire company more environmentally friendly, and this signified for them a change in location, construction, operations (including machinery and bottling), logistics and inputs for products. Due to a dearth of consultants for greening strategies, the company's president and vice-president chose to transfer their current skills (environmental management and construction) and acquire new ones to make changes such as material used for construction, building design (location of windows and vents), greater utilization of natural sunlight, replacement of plastic containers with biodegradable plastic containers which Florex collects and recycles from its vendors, changes in the concentration of products to reduce transaction costs and changes to the delivery schedules to reduce CO2 emissions and other wastage caused by traffic.

The example of Florex demonstrates that in addition to conventional skills in areas such as electrical and mechanical engineering, construction or chemistry, professionals must be able to identify opportunities and create new strategies to respond to the needs that are presented for the company. Adaptability is also essential, as it this skill which will enable members of the labour force to learn and utilize the new technologies and processes needed to green their positions. Focus group participants noted on several occasions that creating a green economy was not just dependent on the skills of persons, but also their attitude and willingness to learn about sustainable development, understand the need for changes and

measures and take the actions necessary to ensure that their jobs and companies become more green.

Technological change

Technological change and innovation play an important role in greening as many of the new technical skills demanded respond directly to new technologies created for responding to climate change. Professionals must understand how to calculate carbon footprint, calculating energy efficiency savings, understand new materials and equipment such as chillers, solar panels and wind turbine systems, green building design, energy efficiency materials and calculations, understand and communicate climate change, carbon trade mechanisms as well as how to offset emissions.

Implications for gender in greening

There are different implications for gender within the context of greening existing occupations. Some affected sectors, industries and positions such as those in engineering, agriculture, technology and energy are often male-dominated. At the same time, increasingly more women in Costa Rica are being educated in these fields, and are seeking opportunities in natural resource management, tourism, education and others. The Center for Tropical Research and Education (*Centro Agronomico Tropical de Investigacion y Ensenanza*, CATIE) recognizes the importance of encouraging greater gender diversity in both its education and administration efforts²⁷. CATIE has instituted policies and programs to evaluate the impact that their projects have on gender, and has carried out conferences and research to promote gender equity and inclusion in natural resource management issues. By adopting a concrete gender policy and action plan, CATIE is making the necessary link between gender, natural resources and productive activity, with the view of examining how gender and natural resource management are intertwined, and encouraging more women to develop their skills in these areas. Dr. Pedro Leon, Coordinator of the Peace with Nature Initiative, believes that gender is of particular importance for creating a green economy as it is many of the women in the Costa Rican households who make daily decisions regarding energy efficiency, water usage, recycling and other matters, and can influence the practices of the other members of their households, including children. He added that this greater awareness and sensitivity is also demonstrated by women in the workplace.

Where are the greatest skills gaps in the country in terms of greening the economy? Shortage in the supply of which skills and qualifications is responsible for the labour market bottleneck in greening the economy?

3.2.3 Identification of skill needs

Given that the concept of green jobs is still somewhat incipient in Costa Rica, new occupations and skill requirements are identified in an *ad hoc* manner, in response to a need identified in a particular organization. This was indeed a recurring point raised during the focus groups, as participants often stressed that

²⁷ CATIE (2005). Available at:
<http://www.catie.ac.cr/BancoMedios/Documentos%20PDF/estrategia%20de%20g%C3%A9nero%20catie.pdf>

that there was a lack of coherence and accorded strategy in terms of the concept of greening the economy and the implication this had at the firm and/or ministerial level particularly for capacity development. Participants pointed out, for example, that the Costa Rican government may have to the policy goal to make Costa Rica the first carbon neutral country by 2021 and recognize the importance of education and skills development, however little has been done to systematically identify exactly how this education and skills development should be carried out. Information provided on websites created by MINAET for the National Climate Change Strategy, or the Peace With Nature Initiative refer to the importance of education at the formal and informal levels through both primary and secondary channels, nevertheless they do not provide specific information regarding a plan to identify and develop skills needs.

Focus group participants pointed out that individual companies, ministries, and organizations identify new occupations and skills requirements and institutions either as needed or in response to shared goals by associations or new government policies. In many cases, initiatives taken by companies such as Florex or Cayuga Tours (CANAECO) are seen as voluntary and self-directed, based on the interests of the company or an individual within the company, not because these were required. Once the decision is made, management often must seek out qualified personnel or train staff to fill the new roles because they often find themselves without the skills sets necessary for the new position. Alberto Garcia of FONAFIFO pointed out that the new skills are often identified as the issues or processes change. He noted that given Costa Rica's involvement in international climate change negotiations, FONAFIFO has had to seek out persons with multidisciplinary skills, including those versed in negotiation and English who can represent FONAFIFO at both national and international negotiations such as the Copenhagen climate summit of December, 2009. These are new necessities and requirements geared at ensuring that the institution maintains its core competency in natural resource and environmental management while still being able to influence the policies and actions essential for creating Costa Rica's green economy and helping the country adapt to climate change.

The different cases on new green collar occupations and greening existing jobs, presented in Sections 3.2.5 and 3.2.6 show repeatedly that many of the occupations which were created or greened were done in response to individual company's needs and goals in response to Costa Rica's climate change and carbon neutral plans.

Efforts to identify skills needs are not restricted to individual companies however. Increasingly, business associations such as the Chamber of Industries of Costa Rica (CICR) and the Federation of Engineers and Architects are identifying the implications of climate change and sustainable development for its members. The CICR for example carries out training and capacity building for its members in response to need identified, and in September 2009, the CICR conducted a study on Industrial Strategy for Climate Change²⁸²⁹ in which it makes several recommendations for education and technology transfer for its members. The

²⁸ Colegio Federado de Ingenieros y Arquitectos <http://www.cfia.or.cr/index.htm>

²⁹ Estrategia Industrial ante el Cambio Climático
http://www.cicr.com/docs/actividades/cambio_climatico.pdf

Institute for Business Excellence (*Instituto de Excelencia Empresarial, IEE*) is the branch of CICR which develops and provides training to its members on an ongoing basis in a variety of topics, in response to the needs identified.

Other associations such as the Federation of Engineers and Architects, which also strive for the continual professional development of its members, emphasize the need for ongoing skills development. The Federation identified Sustainable Construction as an area of importance, and provides documents and publications on impact evaluation and other skills for sustainable construction. In addition, the Federation organizes and provides access to workshops, conferences and seminars on issues such as “Integrating Green Format Data into Project Specification” and “Practices for Sustainable Construction”.

Other initiatives which inadvertently identify skills needs by examining policies and best practices include alliances and workshops such as the “Expert Workshop on Carbon Neutrality in the Agricultural Sector”, which was carried out by INCAE Business School, MINAET, Peace with Nature, and CATIE in February, 2009. In September 2009, several companies such as Coca Cola Costa Rica, World Wildlife Fund, CICR, the Ministry of Foreign Trade of Costa Rica, GTZ of the German Cooperation and others organized the “Competitive Advantages in New Markets through Reducing Ecological Footprint” seminar. This gave professionals an opportunity to learn about initiatives being undertaken at different companies throughout the country to change business practices, reduce carbon footprint, monitor emissions and educate staff and the society. Professionals were able to network, examine company strategies, and identify opportunities and needs for companies.

As mentioned in Section 2.3, Costa Rica has yet to establish a comprehensive information system with relation to natural resource management or green jobs. This hampers systematization of identification of required skills for greening as well as the knowledge transfer to develop the appropriate occupational profiles, curriculum design and training at the national level. Focus group participants were confident that the country’s leadership were headed in the right direction by creating the necessary policies, and felt that the next step was now to systematize curriculum and skills information to ensure that the coming generations would be accurately prepared to green the economy.

3.2.4 Skills response

This subsection analyses effectiveness and organization of the skills response in relation to the challenge of greening the economy with a specific attention to planning of initial and continuing training, institutional frameworks, systemic provisions, delivery channels, ad hoc versus anticipated skills responses, and skills response by different actors and providers.

Effectiveness and organization

Without proper documentation of the current and future training needs, the skills response is a mixture of *ad hoc* institution-based initiatives and others based on strategic alliances among academia and the public and private sectors. Approximately 25 of Costa Rica’s 56 universities and 74 vocational schools offer degree and certificate programs in natural resource management (please see

Section 2.3), signifying the widespread availability of skills development opportunities in a variety of niches and topics. Fields of study include tourism; agro-industry and fishing; natural sciences; industrial, mechanical and electrical engineering; business administration, including corporate social responsibility; energy; natural resource management; project management, finance and many others.

Education and training responses to identified skills needs in Costa Rica are continually being developed by different actors within the country. Various academic institutions have been responding to the growing awareness on climate change and policy changes to create new courses and training programs. Training however is also being developed, as mentioned in Section 3.2.3 by different companies and business associations to respond to skills needs and new or changing occupational standards. There are opportunities for Technical and Vocational Education and Training (TVET), Continual Vocational Education and Training (CVT), on-the-job training programs as well as other external training programs supported by companies and ministries.

Technical and Vocational Education Training (TVET)

There is still no organized coordination mechanism between academia and the public and private sectors to respond to the skills needs for becoming carbon neutral or creating a green economy. The Peace with Nature Initiative admits that while education and technology transfer are important axes for the country's goals to be met, systematic skills responses are still being conceptualized but some actions have been taken, such as in teacher education.

Nevertheless, due to Costa Rica's strong history of environmental awareness, the previous inclusion of environmental education in basic education curricula, and the pre-existence of academic institutions with career-tracks in environmental fields, the foundation for skills response has already been created. Individual universities such as EARTH, CATIE and INCAE have explored different ways to provide students with transferable skills in industry, business administration and natural resource management. In 2008, for example, the National University, which falls under the umbrella of public universities, submitted a proposal to CONARE to create a Licenciature in the Water Resource Management within the School of Environmental Sciences as a response to concerns over the utilization and depletion of water resources and its implications in Costa Rica, Central America and around the globe.

INA has responded to the skills needs by working with the Ministry of Health and other companies to create and design new courses to respond to those organizations' needs. Recently new courses to train persons as Recycling Centre Operators were developed, and INA plans to incorporate environmental management in all courses. INA develops courses for both TVET and CVT, as its catalogue offers a variety of courses for those new to the labour market, as well as those already active in a sector such as tourism for example. INA continues to create innovative new "green" courses, and recently concluded its first "Creation of decorative, utilitarian and artisanal articles from waste"³⁰ course. This course,

³⁰ http://www.ina.ac.cr/mujeres_artesanas_mat_reciclaje.html

geared towards female artisans, is designed to help them utilize recyclable materials to create marketable products.

Continual Vocational Education and Training (CVT)

CVT refers to the education and training programs offered to adults active in the labour market to enable them to develop and strengthen vocational skills and competencies. Many different CVT opportunities exist in Costa Rica, including those offered by industry associations, universities and institutes. As mentioned previously, the CICR established its training institute, IEE, in order to provide its members with the skills training needed to adapt and respond to changes in policies and procedures in industry in Costa Rica. Given the CICR's focus on sustainable development and climate change, the IEE has responded by providing skills training in the areas of Environmental Management, Maintenance for Water Treatment Plants and Renewable Energy under the framework of the Continual Education Program. IEE also organizes other forums and conferences for its clients, and creates custom-made courses at the request of its members to provide training in selected areas.

Different certification programs also exist to prepare persons in the public and private sector to meet standards of environmental management and sustainable development. These include the ISO 9001 on Quality Management Systems and ISO 14001 on Environmental Management Systems, the Certification for Sustainable Tourism (CST), and Leadership in Energy and Environmental Design (LEED) certification, one of the certifications encouraged by the Federation of Engineers and Architects.

The Sustainability Management Program (SMP) offered by the INCAE Business School in collaboration with InWEnt and the German Cooperation is a three-week training course for persons working in both the public and private sector. In order to accept this training opportunity funded by the German government, participants must receive the approval and support of their company in order to participate, with the understanding that the employee must be actively involved in sustainable changes and knowledge transfer at the organization. SMP participants receive capacity development in areas such as renewable energy, natural resource management, project impact evaluation, operations management and other administrative processes, with the view of incorporating sustainability practices in all areas of policy and administration.

Certificate in Sustainable Tourism (CST)

The CST³¹ was designed to differentiate the tourism sector business based on industries efforts to comply with a sustainable model of natural, cultural and social resources management. Four fundamental aspects are evaluated within the audit process:

1. Physical-biological parameters: evaluates the interaction between the company and its surrounding habitat;

³¹ <http://www.turismo-sostenible.co.cr/EN/home.shtml>

2. Infrastructure and services: evaluates management policies and operational systems within the company and its infrastructure;
3. External clients: estimates how the company interacts with its clients in terms of their active contribution to company sustainability;
4. Socio-economic environment: analyzes the interaction of the company with the local communities and the population in general.

The CST is regulated by the Costa Rican National Accreditation Commission of the Ministry of Tourism (ICT) and comprises of five levels, which are assigned according to the degree of sustainable tourism achievement. If Level 1 is obtained, the firm has taken the first step in the process of sustainability. The higher levels represent more advanced steps, reaching up to Level 5, which signifies that the company is considered as an outstanding example in terms of sustainability. To achieve Level 3, companies should complete at least 60 per cent of the established conditions for four evaluated areas.

Peace with Nature Initiative Teacher Education Project

The Peace with Nature Initiative implemented a teacher education project in 2007 geared towards re-training all teachers at the primary and secondary level regarding environmental issues such as waste management, recycling, water management, energy and other issues. The goal has been to provide teachers with hands-on knowledge regarding climate change which they can later incorporate into their teaching programs. The program kicked off with the support of MINAET, the Ministry of Health and the Ministry of Public Education (MEP) and the participation of 40 teachers from two school districts. The teachers receive seven days of training, complete with educational site visits to INBio, EARTH University and other organizations instrumental in climate change issues in Costa Rica. According to Dr. Pedro Leon, the first teachers volunteered for the program however the feedback has been positive and now there is a list of school districts pending the opportunity to send teachers to participate in this training.

As the case studies will demonstrate, different institutions have responded to their skills needs by sending personnel to receive training at academic institutions, developing on-the job skills development, and still others seek capacity development opportunities through professional and business associations. In spite of the many academic initiatives, a comprehensive and publicly available feedback system between the economic sectors and academia still does not exist for skills needs and responses to evaluate the effectiveness of available education at the national level.

3.2.5 Case studies on new green collar occupations

Case Study 1. INCAE Business School, Coordinator for Internal Projects on Energy and Natural Resources

Background

INCAE Business School (or Central American Institute of Business Administration), founded in 1964, has campuses in both Costa Rica and Nicaragua. INCAE has had a long-standing focus on research and education focusing on business administration, competitiveness and sustainable development. The Latin American Center for Competitiveness and Sustainable Development (CLACDS by its Spanish initials) was established in 1996 as INCAE's main applied research center, facilitating cooperation among international organizations, governments, companies and other stakeholders.

INCAE's – C-Neutral 2012

INCAE is a recognized leader in sustainability issues in business. As such, it is critical for the Institute to “practice what it preaches.” INCAE has made important strides in on-campus environmental management over the past four years. Efforts have included energy savings and efficiency, recycling, water management, and engagement with students, faculty and staff on these issues. Given the increased awareness and concern regarding global climate change, INCAE seeks to establish a leadership position regarding its own GHG emissions profile.

In 2008, the President of INCAE proposed to reduce INCAE's net greenhouse gas emissions to zero by 2012. The project was to be managed by INCAE staff, therefore the decision was made by the University President and a team of faculty specializing in sustainable development to create a new green job – that of Coordinator for Internal Projects on Energy and Natural Resources. The incumbent for this new position was contracted to coordinate INCAE's efforts, supported by a team of two managers in the upper administration, an INCAE's professor who specializes in Sustainable Development, as well as external consultants as needed.

Coordinator for Internal Projects on Energy and Natural Resources

The Coordinator for Internal Projects on Energy and Natural Resources³² is responsible for carrying out all projects to make the institution carbon neutral by 2012. The coordinator regularly carries out surveys and inventories of INCAE's two campuses (Costa Rica and Nicaragua). When INCAE sought out candidates for this new post, the person selected had just received a Master's Degree in Industrial Engineering, and taken courses in Operations Management, Simulation, Industrial Administration, Process Design, Economic Engineering, Environmental Management, Climate Change, and other courses. Additionally, the candidate's final group project examined waste collection and recycling SME operations

³² This information is based on interviews with Ing. Giannina Bontempo, Coordinator for Internal Projects on Energy and Natural Resources at INCAE, and Ing. Juan Manuel Ortega, the interim coordinator.

throughout Costa Rica, thus applying industrial engineering studies where greening has begun in the country.

The coordinator felt that her studies at the university level prepared her administratively for her post, however she has had to learn the technical skills such as management of the electrical systems and equipment, calculation of the carbon footprint and mechanisms for incentivizing energy savings for the organization on the job.

Further training

The coordinator has begun a new technical training program, encouraged and suggested by her supervisors, on Energy Management and Leadership. This program is organized by the German International Cooperation and financed by the government of Germany as part of development cooperation between Germany and Latin American countries. The coordinator will receive training in German and spend approximately four months on technical training in Energy in Germany, and then another four months carrying out an internship in an energy services company in Germany. At the end of this period, the coordinator will return to INCAE to apply her newfound knowledge in projects at the institution. INCAE recruited another coordinator, educated in Industrial Maintenance Engineering, to oversee internal projects. The interim coordinator has prior experience in project management in construction and meteorological measurement and evaluation for wind energy stations.

INCAE ESCO

INCAE implemented a very simple strategy to manage its energy use, goals, investment, planning and monitoring. C-Neutrality establishes the goal and general parameters, only simple additional guidance and direction is required. Additionally, INCAE is establishing Energy Services Company of INCAE (ESCO-INCAE), as a vehicle to analyze, plan and execute its energy strategy. The ESCO will be run as an INCAE “small business”, under the direction of the new coordinator, with advice and supervision from a committee. The ESCO is a proven mechanism that invests in companies’ energy conservation and efficiency and shares in a percentage of the cost-savings.

ESCOs tend to be highly profitable, and are extremely agile in decision-making and investing. Since they are a separate company they are not subject to company CAPEX processes³³, but rather operate with their own assigned capital budget or credit line.

A number of leading firms have decided to form in-company ESCOs that operate as subsidiaries. This approach provides the benefits of an ESCO – speed, flexibility, etc.– but allows all the profits to accrue to the parent company – those coming directly from the cost savings, and those coming from the profitability of the ESCO.

³³ CAPEX is the acronym for Capital Expenditure and concerns procurement processes of capital in a company. Major expenditures need to go through various levels of approvals in a system, before it can be approved.

INCAE carried out consultations to determine the carbon footprint on the two campuses of INCAE (Francisco de Sola in Nicaragua and Walter Kissling Gam in Costa Rica), i.e., emission sources, consumers and the actions that generate them. They also identified opportunities for savings. From these findings, the committee develops environmental strategy. This involves actions such as changing the lighting in buildings and homes, air conditioners, heating systems. But it also involves actions on the regular staff and residents, to change consumer habits (no lights left on, saving air conditioning, garbage recycling, etc.).

Multiplier effects: Training

The Coordinator for Internal Energy and Natural Resources Projects has been re-training area managers to help them understand the actions and expected impacts of the project, so as to further re-train all staff members. Those who have received formal training include: Director General of Administration and Finance, the Manager of Maintenance and Accommodation; Cafeteria (outsourced to another company); Cleaning and Laundry (outsourced), Budget Manager, Internal Auditors, Research staff, Director of Supplies and Transportation (outsourced).

In addition, there is training to all staff and students through different channels. These include placing posters in various places, including in all bathrooms, with environmental tips, talks to staff, personnel from other companies providing services to INCAE (such as the catering company), and students. The latest of these training talks was held in October 2009 on the Walter Kissling Gam Campus in Costa Rica, and was attended by 50 per cent of the staff of the campus.

The staff training is focused mainly on the consumption patterns of electricity (in lighting, air conditioners, water heating) and others such as paper use, recycling of solid waste classified. There has also been an explanation of the Climate Change phenomenon and the ways in which people can contribute to the mitigation efforts in the household, business, community, and country.

Conclusion

The future leaders of the region who are trained in INCAE must have knowledge of sustainable development and practices, attitudes and values related to lead the region toward that goal. The necessary learning must come from a combination of classroom experiences, life on campus and the faculty, staff and colleagues. INCAE, by recruiting an energy and natural resources coordinator, has created a new green position and, at the same time, ensured that there is knowledge transfer at all levels to increase awareness and change behavioural patterns.

A critical aspect of INCAE's mission is environmental performance on campus and in their operations, of all people who work or are involved regularly with the institution. INCAE therefore works hard at its training programs have these contents of sustainability and social environmental responsibility, and has training its staff and consultants to that end. INCAE is certain that in the future related professions leadership positions in private companies and public institutions must have a strong environmental component, even if this requires creating new positions and seeking the right candidate with transferable base skills, leadership capabilities and understanding of the current environmental initiatives.

Case Study 2. Dole Costa Rica³⁴: Ten years of responsibility

Introduction

Dole is a leading company in the agricultural sector. Its core business is the production and packaging of fresh fruits. Dole Costa Rica is dedicated to fruits exports mainly. Currently the company shares 30 per cent and 15 per cent of the banana and pineapple markets in the United States, and 20 per cent and 15 per cent in Europe, respectively.

Dole was the first global agricultural company to be certified ISO 14001 (environmental management systems) for over ten years. Some major transformations related to their sustainability policy include integrated management systems efforts that include good agricultural and operational practices. Today management systems also incorporate: occupational health, food safety, security, and social and occupational functioning. These systems have been certified by various standards such as ISO14001, ISO9001, Global GAP, GMP (Primus Labs), Rainforest Alliance, BASC, SA8000 (Social Accountability), among others.

Since 2007, climate change issues have been included in their management systems and Dole has been working on measuring and reducing its carbon footprint, developing a compensation bill, and ultimately the lock-chain partnership on mitigation. These efforts are highly motivated by Costa Rica's strategy to differentiate its export products, particularly in the European market.

Background

The first new green jobs initiatives at Dole emerged ten years ago when Rudy Amador, Director of Corporate Social Responsibility, established a corporate strategy in Environmental Management Systems. At that time, jobs to manage environmental practices were created at the field level. Later, these new positions expanded to other areas such as occupational health, product safety, and social and labour issues. Currently, main efforts are directed to evaluate the impact of Dole activities on climate change. As a result a new job was added to coordinate the company's C-neutral program.

The process of environmental management has become an integral management system. Training programs (continuing today) were imparted of all staff members including agricultural workers and managers. Also, the Board has been assigned to meet specific roles and responsibilities. Several training activities have been given to neighbouring families and schools, located near to Dole's operations in order to increase their awareness on climate change and natural resource management issues, including company's inner initiatives.

New green jobs

Most of Dole's labour force is composed of agricultural field workers who perform various intensive activities such as planting to harvesting. Field supervision and administration staff is required to have agricultural experience and

³⁴ Based on a personal interview conducted to Rudy Amador, Director and member of Dole's CSR Team Costa Rica, on 2 November 2009.

formal education ranging from technical instruction to a university degree like agronomy.

Main required positions to support production include: agricultural engineers with a specialization in soils and drainage, civil engineers for construction and maintenance of farm infrastructure (packing houses, design cable routes, administrative buildings); managers (human resources and payroll, financial control, accounting, production logistics, environmental and social management, etc.), technicians and mechanical engineers for maintenance of machinery, agricultural pilots, agricultural research staff (for research and development).

To properly implement management systems (environmental, quality, social) is necessary to establish training programs based on the target standards (e.g. ISO 14001 and SA8000). This process requires the insertion of several sources of knowledge (environmental, occupational health, legal, safety) and may take several years to be acquired.

Dole hired 15 people associated with this change process. The positions are currently filled by 14 men and one woman. Their professions are: one occupational health specialists, three occupational health technicians, one engineer, one environmental auditor, three agricultural engineers, six technicians with high school diplomas in agriculture or environmental management. Several of these jobs titles did not exist ten years ago. Dole has been a leader in the industry creating these new green collar positions.

Environmental Auditor Profile

This employee must possess an academic degree (mainly environmental or agronomic engineering). To date, the best environmental auditor has been a biologist. Due to Dole's vertical operations, the auditor has had to obtain experience in other activities (port operations, carton production, agriculture aviation, transportation, among others). Also the employee had to receive training in different norms including regulations and different standards (ISO 14001, GLOBALGAP,³⁵ SA8000, Rainforest Alliance, Tesco Nature's Choice). Main responsibilities for auditors include:

Management Systems Auditor

- Conduct Management System audits according to the person's accreditation;
- Provide objective information about farms environmental development;
- Initiate preventive and/or corrective actions and identify and control nonconformities to prevent recurrence;
- Ensure compliance with Environment Management Policy and Social Responsibility, Objectives, Operational Controls and Management System Programs

³⁵ GLOBALGAP was formerly known as EUREPGAP. It sets voluntary standards for the certification of agricultural products. It establishes standards for Good Agricultural Practices (G.A.P.).

- Ensure that labour laws, established risk control measures and job conditions are respected;
- Manage compliance with GLOBALGAP, Tesco Nature's Choice and every norm adopted by the company and;
- Closure of nonconformities to norms according to the person's accreditation.

Internal Auditor for GLOBALGAP

- Conduct audits of the Quality Management System (QMS) for the Independent Producers Group according to the GLOBALGAP standards;
- Initiate preventive and/or corrective actions and identify and control nonconformities to prevent recurrence;
- Communicate to the Management Systems Administrator Representative the results of the internal audit QMS performed to the Independent Producers Group according to the GLOBALGAP standards;
- Manage the closure of nonconformities of QMS for the Independent Producers Group according to the GLOBALGAP standards.

During the last years, the company has experienced several sales issues and has also been subjected to trade restrictions in the European markets since the first environmental management system was implemented. Despite the economic crisis, "green" staff members have been supporting best practices within the company.

In order to achieve a greener market position, the company has implemented a transition-training period for their employees. Some employees with "traditional" or "conventional" managerial experience had to update their methods to operate more effectively in an environment sound way. Dole has emphasized the importance of staff empowerment in all positions.

In terms of training, the Company handles the concept of "Training Cathedra". A person is in charge to coordinate all aspects of our courses, which are given by Dole's employees and also external sources. As part of this job, training coordinator has the subsequent roles:

- Identify training needs and develop training programs to achieve environmental goals;
- Initiate preventive and/or corrective actions, identify and control nonconformities to prevent recurrence;
- Ensure compliance with Environment Management Policy and Social Responsibility, Objectives, Operational Controls and Management System Programs;
- Coordinate training for workers in occupational health and safety, environmental awareness, preparation for emergencies;
- Manage compliance with GLOBALGAP, Tesco Nature's Choice and every norm adopted by the company and;
- Support heads of departments, if requested, in the process of identifying training needs or the development of training programs;

- Check with the System Representative and/or heads of areas, at least once yearly, the requirements for jobs in order to update;
- Schedule, coordinate and evaluate training activities;
- Train internal instructors;
- Develop or oversee training manuals;
- Provide, as required, progress reports of training programs to General Management, farms and departments.

A complete list of the courses given to employees as part of the Training Program at Dole is presented in Annex E.

Labour market

Ten years ago, when Dole began to implement its environmental management systems, there was no formal education in this area. The company also found limited training services in these topics. However, the education system (both private and public) currently graduates professionals having at least basic knowledge regarding sustainability.

Currently, the company has built alliances with academic instances such as University of Costa Rica, Technological Institute, Earth University, and INCAE. Dole frequently hires professionals from this universities, and offer internship opportunities for students. As a general opinion, Costa Rica's educational system provides trained personnel to meet new jobs demand.

Conclusions

In general, business management requires knowledge to implement sustainable practices (environment, occupational health, community, healthy and safe products), essential to produce export products according to the customer's and industry standards. These skills facilitate the incorporation of sustainability along the company's value chain.

It has been stated that professionals must be trained in order to become greener. Rudy Amador from Dole declared that:

"I think that green job profiles are very important. It's not enough to produce a product of good physical quality ... now what is important is how the product is produced, as this is an intrinsic part of the final product. However, I consider that today's professional must have a general knowledge, which always includes sustainability as one of its key components...but not the only one. For our company agriculture, finance professionals or engineers remain more important than environmental technicians lacking knowledge in the mainstream business. Nonetheless, these professionals will be at a significant disadvantage in the future labour market if their skills in terms of sustainability haven't been developed during the formal education process".

Case Study 3. Management of Solid Waste in Costa Rica's Greater Metropolitan Area³⁶

Introduction

In Costa Rica, municipalities are obliged to collect, manage and dispose of solid wastes in their communities. In some municipalities this process is negatively affected by budget and human resource constraints or because they are low population density zones; which makes it less cost-effective to provide these services.

In rural communities where these services are not provided, people can throw solid wastes into rivers and waste land areas or burn them, thus contaminating the environment and creating a health risk for surrounding population.

Country Management on Municipal Waste Management

Solid waste management is a “hot spot” for the country, mainly for the Greater Metropolitan Area (GMA), which generates more than 56 per cent of the country solid waste. As stated by Terra Nostra³⁷ (2008), Costa Rica generates approximately 4,500 ton of residential solid waste daily. From this figure, nearly 30 per cent is dumped into rivers, empty lots or other public areas. The situation worsens in urban areas, where each person generates more than 1 kg of waste daily. Also, final deposition in landfills is an aggravating issue since there are only four facilities serving the whole country.

The GMA lacks a Solid Waste Integral Management Plan, there are not enough and reliable statistics to facilitate the implementation of necessary measures for treatment and disposal of these wastes. There are not enough authorized dumping sites to dispose wastes and some of the existing is coming close to their capacity. Additionally, there are not enough clean technology mechanisms in Costa Rica for goods production that can help reduce the volume and composition of biodegradable solid wastes. Finally, there is a misperception of how serious the problem actually is for the GMA, and how it can worsen if no measures are taken to curb current trends.

Legal framework for Integrated Waste Management

On 17 June 2007, the Environment Permanent Special Commission defined a new draft text for the Integrated Solid Waste Management Law (Ley GIR, by its Spanish initials). This regulation was conceived as part of a previous participative process, which took more than a year of preparation for the Joint Committee.

The Committee was integrated by representatives of public institutions, academic and municipal sectors, environmental and waste management NGOs, and productive sector. All stakeholders worked together under the leadership of the

³⁶ This case is based on personal interviews with different people listed in the reference section in the list of key resource persons.

³⁷ Asociación Terra Nostra emerged to promote active citizens participations in lifestyles improvement, conservation and rational utilization of Costa Rica's natural resources.

Environment Permanent Special Commission members. This initiative was published on Costa Rica's Official Journal La Gaceta on 29 June 2007 in order to comply with the publishing constitutional principle and also to allow the incorporation of elements provided by citizens (Asociación Terra Nostra, 2008).

Main innovations considered by the Commission regarding Costa Rica's National Regulation for Waste Management are:

- National Education Program
- Citizen participation
- MINSALUD-municipalities to apply regulation through joint efforts with communities
- Tools for Solid Waste Management Regulation: recognition, life cycle analysis, environmental analysis, environmental agreements, soft credits, accelerated depreciation, deposit-refund systems, green purchasing
- State green purchases
- Record of managers
- Criminalization of illegal traffic
- Regulation for waste imports

Costa Rica Solid Waste Plan (PRESOL)

This plan is a national joint effort by many institutions and sectors. The initiative arose from the urgency to solve the problem of poor management of solid waste and negative environmental and health impacts in the country. This has been one of the greatest problems for central and local governments, who have made attempts to try to improve the situation.

With this background, the Coordinating Commission for the Search of an Integral Solution to Solid Waste Management, which involved the following Ministries: Health, Environment, Energy and Telecommunications, Public Works and Transports, Public Education, the Municipal Training and Instituto de Fomento y Asesoría Municipal (IFAM) and the National Environmental Technical Secretariat (SETENA) was launched in 2006, in conjunction with the Competitiveness and Environment Program (CYMA) a process to analyze the solid waste management in the country and propose a sustainable solution.

The above-mentioned Commission appointed a Technical Committee and hired an international consulting firm. They started the process of developing a waste plan, a new management tool. Then a diagnosis of Costa Rica's solid waste situation was constructed through consultation workshops and validation, which included more than 430 people. In this process, 31 strategic actions were defined and grouped into five areas of action:

- administrative-legal
- technical
- education and awareness

- institution-organizational
- economic

These actions are presented in PRESOL like working tables leading daily initiatives in waste management. Each action is accompanied by a goal to be accomplished, an indicator to measure compliance, intermediary results expected deadlines and an overseer.

Human resources: Profiles for professionals

One of the main problems reported by interviewed experts, suggests that Costa Rica has insufficient human resources trained to solve issues mainly related to waste management. It has to be taken into consideration that for example, organic waste represents more than 50 per cent of total generation. Since municipalities lack a formal plan to treat organic waste, most of it is dispatched to landfills. Decomposition of organic matter in landfills generates methane, which is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide (CO₂) (EPA, 2006).

Waste manager at EARTH University, with an experience of four years working with municipal and agricultural waste in Guanacaste, has stated that an employer will look for the following qualifications and skills when hiring a potential professional in waste management:

- Logistics and transportation experience
- Systems theory knowledge
- Creativity
- Organic chemistry knowledge

At a national level, few persons have been formally trained in waste management. In the case of Guanacaste, one of Costa Rica's most touristic zones, the first environmental manager started to work in Liberia municipality three years ago. The province is divided in eleven municipalities and only five of them have a formal environmental manager. This person is in charged of all environmental issues related to the person's territory, leaving insufficient resources to plan and solve waste management concerns.

Company experiences: Servicios Ecológicos M.B.B. S.A.

This company was created in San José in February 2001. It offers training services geared to ecology conservation, recycling and waste management re-utilization. The company also recycles all types of materials.

As part of its social policy, the company has integrated community aspects into their waste management services. Several projects have been implemented to benefit social oriented organizations through private donations. From this standpoint, Intel's initiative is extremely important due to its contribution to Costa Rica's economy.

Company experiences: Componentes Intel Costa Rica

A joint project between Intel Components Costa Rica, Servicios Ecologicos and Belen municipality was established to offer effective treatment to solid wastes and re-usable products derived from Intel's activities. Generated funds from the commercialization of these products are donated to schools in Belen. Due to this type of green strategies, companies like Intel require new professional skills to address their sustainability goals.

Intel jobs, in general, are highly specialized in technology since the company must meet top-level performance goals in order to be competitive worldwide. An Environmental, Health and Occupational Safety Department was established to direct the company toward sustainability achievements. Ten professionals from several backgrounds including environmental engineers, occupational engineers, ergonomists, health technicians and nurses, among others, integrate this division.

According to Intel's Environmental Manager, Anibal Alterno,³⁸ environmental engineers are very scarce in Costa Rica. Recently, Universidad Nacional (UNA in Spanish) graduated its first generation and Instituto Tecnológico de Costa Rica (ITEC in Spanish) is offering this career. In addition, Universidad Técnica Nacional (UTN in Spanish) has a study plan in Environment and Occupational Hygiene.

Regarding the short supply of professionals in this field, Mr. Alterno suggested that a poor enforcement of Government regulations has led to low demand of environmental professionals by small and medium-size companies. These businesses tend to hire consultants or technicians to accomplish their environmental obligations. Nonetheless, transnational and larger corporations have recruited professionals with a strong academic background in environment-related careers. Few companies in Costa Rica are willing to invest in leading professional know-how trained in the country or abroad to manage their sustainability policies.

Componentes Intel de Costa Rica has recruited two environmental engineers to manage environmental programs. They need to address present procedures to improve to meet legal requirements. Some site programs include:

- Legal requirements management
- Refrigerants handling;
- Solid waste management (standard, electronic and chemicals)
- Underground water protection;
- Treatment plant management;
- Audits program management (ISO 14000);
- Air program (emissions)
- Projects.

³⁸ Alterno, A. (2010). Environment, Health and Occupational Safety Manager. INTEL. Heredia, Costa Rica (interview).

Environmental Engineer Profile requested by Intel³⁹

Main qualifications to obtain a position as Environmental Engineer at Intel include the following:

Must have a professional academic background in Chemistry, Environmental or Industrial Engineering. The academic degree is a must have since most hired professionals will need to receive further intense training in more specific fields like Management Systems (ISO 14001) and related components: waste and toxic waste management. For instance, if an industrial engineer is hired as an Environmental Manager, he/she may need to learn technical skills like health, ergonomics, and toxicology. The professional profile must be suitable to adapt to environmental related fields. Moreover, the professional needs to have strong communication skills to address issues with Government entities or agencies, outsourced services and community leaders.

In Intel's case, general waste management is carried out on different sources. There are several labeled containers located along the plant to facilitate the materials segregation (aluminum, carton, plastic, etc.). An outsourced party is in charge of picking up the materials to treat them according to their chemical composition. Chemical wastes, on the other hand, are treated and processed differently to meet requirements. A specialized technician has been hired to oversee this operation. Also he/she is responsible of the following activities:

- Storage room management
- Inventories
- Related activities coordination

Componentes Intel de Costa Rica offers training to environmental engineers. A development plan for the position includes basic courses related to environmental programs, ISO, support courses such as seven steps to solve a problem, leadership, effective communication, etc. According to the person's field of expertise and management responsibilities, development areas are identified in order to assign training. Most of training is outsourced: hazard waste management, treatment plants, C-neutral, etc.

All employees must undergo training in the required areas. Training courses cover environmental awareness, recycling, site environmental programs and some are job-specific (water protection, hazard waste management).

Electronic waste management is a component of the waste integrated management plan, managed by a corporate contract for its disposition and collection. Personnel Computer Service picks up office electronic waste. These devices are then stored in the hazardous waste room. Manufacturing electronic waste, on the other hand, are sent directly to the waste room. From storage rooms, gadgets are sent to a contractor for its export.

³⁹ At Intel, the Environmental Engineer is in charge of Waste Management, among many other activities.

Conclusions

- Costa Rica still lacks expertise in waste management and municipalities along the country have insufficient resources to address related problems. New opportunities for waste management (including new technologies) are emerging for the private sector.
- Due the size and growing importance of the national waste management sector, government needs to address regulation more proactively. This has lead to a poor demand of environmental professionals within the country labour market.
- A skilled professional in all levels will be required to meet industry needs when regulation will enter into force.

3.2.6 Case studies on greening existing occupations

Case Study 1. Precision Agriculture in Costa Rica⁴⁰

Introduction

During the last 25 years, Costa Rica's agricultural development was promoted towards diversified and exportable goods to reduce the economic vulnerability from the dependence on traditional crops. Additionally, trade agreements and treaties with the international community have made it necessary to promote agriculture exports with added value.

Given factors such as the Costa Rica's brand as a "green country", agricultural practices that are socially and environmentally sound should be taken into consideration. Truly sustainable agriculture requires investment in research and development of advanced technologies (Arias, 2005). In the past, detailed knowledge in agriculture was difficult to acquire. Recently, however, advances in technology and communications have removed previous barriers. Sensors and microprocessors –coupled with integrated software, mobile power sources, and satellite communications– enable farmers to collect a significant amount of geo-referenced data. Further processing of this information produces valuable information in terms of environmental and economic impacts for a farmer or a natural resources manager (Schmoldt, 2001).

Natural variability between and within fields has enabled mechanized farming to only apply inputs for average soil, nutrient, moisture, and weed and growth conditions. This has caused over and under applications of herbicides, pesticides, irrigation and fertilizers, except on average sites. For this reason, "precision agriculture technologies are being developed that can sense micro-site specific conditions in real time and can automatically adjust treatments to meet each site's unique needs" (Schmoldt, 2001).

Costa Rica's key efforts to develop a more sustainable agriculture at the national level must include the investment in training engineers and related professionals in this field. Of the total agricultural production in Costa Rica, only 10 per cent is organic agriculture and the rest is cultivated through conventional

⁴⁰ This case is based on personal interviews with different people whose list is provided in the reference chapter in the list of key experts.

traditional practices. Efforts are therefore required to ensure more efficient production with less environmental impact for the other 90 per cent of the country's agricultural production. The various factors for the conditions for sustainable production include:

- (1) agricultural production costs tend to be elevated due to labour costs as well as the importation of certain inputs and whatever best practices that helps optimize the costs of the supplier companies;
- (2) the existence of a national country strategy emphasizing sustainable development and environmental conservations, and;
- (3) water availability, use of renewable energy, carbon neutral strategies and other related issues.

While these conditions represent a general trend, which may support farmer's decision to implement precision agriculture in their farms, traditional practices will not be immediately substitute by new technologies. Mainly, large-scale farmers and transnational companies utilize precision agriculture in Costa Rica but most of the small and medium size farmers in the country lack enough capital and skills to apply this technology effectively. Remote Sensing, Geographic Information Systems (GIS), and Global Positioning Systems (GPS) are technologies required to maximize benefits. Nonetheless, application requires special skills from farmers, professionals and, involved costs per hectare are considered high for the average producer in the country.

According to Seelan et al. (2003), it is important to supply training to farmers and their operators about how to interpret the information received by high technology devices, which may include data collected from variable-rate fertilizer applications, fungicide applications, quantification of losses due to spray drift damage and monitoring physical damage due to insect, inundation, among others.

Country background in precision agriculture

In spite of Costa Rica's evolvement towards more manufacturing and services activities, agriculture continues to represent almost 7 per cent of the GDP and 22 per cent of exports. Banana, pineapple, coffee and decorative plants are the primary export products. It must be noted that edible fruits and vegetables are the second highest exports from the country, behind electronic and electrical products and materials.

Costa Rica's experience in precision agriculture is incipient. The concept started to be used approximately 15 years ago by transnational companies. For its part, the productive sector initiated efforts to implement it nearly six years ago. The private sector has been driven toward this technology due to:

- (1) Cost reduction;
- (2) Increase in productivity;
- (3) Environmental concerns, and;
- (4) Traceability.

As part of their commitment to meet GLOBALGAP and Rainforest Alliance standards, among others, precision agriculture plays an important role.

Human resources

Profile

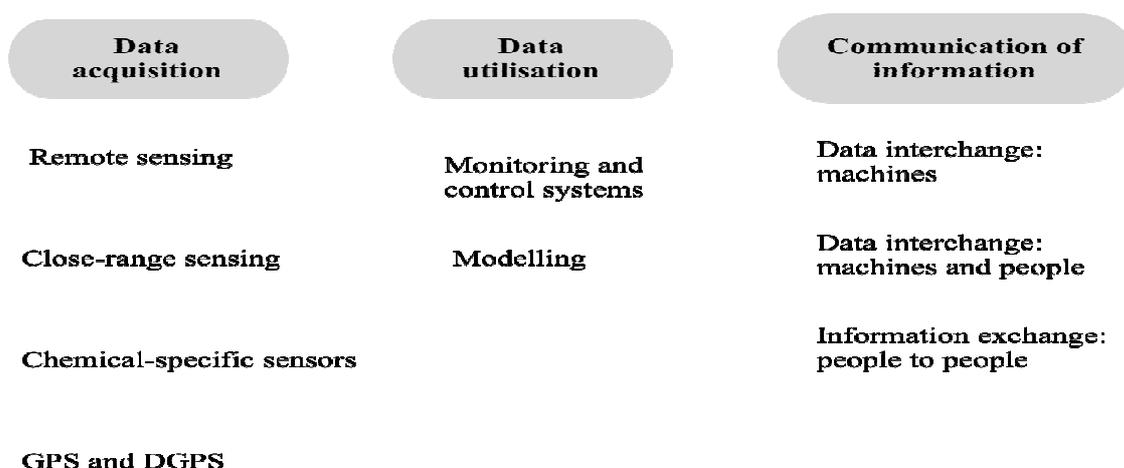
It is relevant to consider the variety of farm actions that will require different levels of skills in precision agriculture. For instance, landowners should train their field operators to understand how to handle technology devices and software. Most of the equipment manuals are commonly written in English. Also, when an expert is brought from abroad to train farm personnel, commonly English is the utilized language, representing a barrier for effective instruction. The language is not usually learnt unless required by drivers or operators in rural areas in the country.

According to several interviews conducted, academic experts and managers of agriculture companies agreed that in order to qualify for a professional position in precision agriculture, in general, candidates must have the following list of qualifications.

- Must be a MSc. Agriculture Engineer, Soil Sciences, Statisticians
- Agriculture machinery experience;
- Geographic information systems (GIS) knowledge;
- Geo-statistical and statistical knowledge,
- Fumigation equipment and application techniques;
- Multispectral photography experience;
- Business administration.

Special knowledge in information technology required by professionals include the following:

Figure 2. Skills required by professionals working in precision agriculture



Source: Cox, 2002.

At most, four to five specialized professionals are working in precision agriculture in the country. One of them is working for Chiquita Brands. The rest of them received training in the United States as part of commercial houses programs. Also, there are some experts in satellite photography techniques working for Ministry of Science and Technology (MICIT).

Training, education and services

AGRIPRESA has been a leading company offering training in precision agriculture as a global concept (organization, goals, strategic planning) to large-scale farmers and transnational companies. The company is associated with SST (an agricultural software development and information services provider) and Oklahoma University. In their joint efforts, they have systematized the process of data collection through analysis, methodologies development and management. According to the company CEO, Mr. Corella, a single software tool is able to manage the entire process. As a practical example, a 43,000 ha farm of sugar cane in Colombia can be managed by three specialists utilizing the appropriate software.

In Costa Rica, AGRIPRESA had established pilot programs in farms to demonstrate the benefits of the technology. Main crops subject to this research include: sugar cane, rice, grasses, banana, pineapple, coffee, heart of palm and oil palm.

Several companies, including John Deere, CRAISA and MACORI have been offering precision agriculture re-training in recent years, but specifically directed to their staff. Employees are sent to the company's headquarters in the United States to acquire skills in hard precision agriculture technologies. Some training areas may include engineering innovations, information management. These services are not provided locally and must be received by employees overseas. CRAISA, for instance has personnel working specifically in this precision agriculture.

EARTH University instituted a course in Precision Agriculture in 2008 due to the increasing demand presented by their students. At most 55 students had taken the elective class. Due to the University international background, most of the students come from several Latin American countries, a maximum of ten graduates remain in Costa Rica.

Sustainable Markets Intelligence Center (CIMS)

The CIMS emerged as a private initiative from the Latin American Center for Competitiveness and Sustainable Development of INCAE. CIMS is an organization dedicated to provide market information about sustainable products in Latin America. In January 2009, CIMS initiated a joint project with *Instituto del Café de Costa Rica* (ICAFE) and four clusters of coffee cooperatives. The main objective of this study is to measure the economic and environmental impacts of the implementation of a precision agriculture program on a coffee farm. The research team is composed of three CIMS staff members who are experts in sustainability. Dr. Bernard Kilian⁴¹ was designated to lead the project and train

⁴¹ Dr. Kilian has vast experience in precision agriculture in Europe, United States and more recently in Costa Rica.

other members to manage software (ArtView) and also to collect data for further analysis. In order to have a successful project, the professionals involved must develop strong skills in statistics, as this is the basis for data collection and analysis.

Rice producer

It is expected that by 2011, approximately 20,000 hectares of the rice grown in Costa Rica will be done by precision agriculture. Fabio Chaves, a large-scale rice producer in Guanacaste, stated that one of the main problems encountered while implementing precision agriculture relies on his machinery operators inability to speak English. Since most literature (manuals) is presented in English, local technicians have issues interpreting the information and understanding the equipment functions and mechanisms. Additionally, top experts coming from abroad experience difficulties training personnel due to language incompatibility.

Mr. Chaves pointed out that he had also faced import issues with machinery. Custom officers are not knowledgeable with precision agriculture instruments, charging taxes for equipment, which in principle should be tax exempt.

EARTH University

EARTH University is a private, international, non-profit university dedicated to education in the agricultural sciences and natural resources. The institution is committed to sustainable development in the tropics by teaching their students the balance between agricultural production and environmental preservation. EARTH began implementing a course on precision agriculture in 2008. Approximately 45 students had taken the course since its inception. Since EARTH is an international university, a high percentage of trained students return each year to their respective countries. At most ten graduates remain in Costa Rica. Detailed course content is presented in Annex F.

Student experience

Marco Dávila and Víctor Urgiles, both students at EARTH University, were interviewed to address their experiences while attending precision agriculture classes. They had received a complete course in the topic but also extra classes in GPS management. Even though, they had theoretical knowledge, their exposure to the practice has been limited.

Main barriers that restrict their development in the field are: high technology equipment access, as well as time and real situations that applied to the topic. Students have had to learn how to use specialized software such as: ArGis, ArcMap, among others.

It is worth mentioning that EARTH emphasizes precision agriculture principles in several of its courses, mainly through the efficient use of inputs in order to minimize costs and environmental impacts. From this standpoint, the inclusion of precision agriculture in the university program is a plus in sustainability. As part of feedback to improve overall course coverage, students recommended to add a component of small-scale farming.

Conclusions

- Precision agriculture is an incipient concept in Costa Rica. Nonetheless, it offers several tools to reduce costs, increase productivity, and comply with environmental concerns and traceability.
- Few highly specialized professionals are working on precision agriculture in Costa Rica. Only large-scale farms are willing to hire this type of skilled workers.
- Mainly private universities such as EARTH University offer training in precision agriculture. Also private companies like AGRIPRESA are training farmers and their workers in data collection.

Case Study 2. Ramada Herradura Hotel: Becoming an environmentally sustainable Operation⁴²

Introduction

Hotel Herradura is located in Heredia, approximately five minutes away from the international airport, Juan Santamaría. The hotel, which belongs to the Ramada chain, has been operating in Costa Rica since 1975. Today it is recognized as the best Four-Star hotel due to its well-established standards in service.

The Hotel's administration, increasingly aware of the environmental problems at the national and international levels and the role that both the private sector and civil society ought to play, operates daily under the premise of developing an environmentally sustainable entity.

Currently the Hotel has taken concrete steps to diminish its impact on the environment. Some of its actions include a reduction in the hotel energy consumption, landscaping changes, furniture acquisition, and provision of food, among others. These initiatives have introduced an opportunity for their employees training, as well as the sequential creation of new staff positions, which enable a successful leadership in the direction of the greening process, in order to create an integrated sustainable hotel operation.

Background

The hotel operates three business lines: accommodation, restaurants and special events (mainly at their International Convention Center). Other services have been given as concessions to third party operators (casino, tour desk, rent-a-car desk, gift shop, spa).

Due to business characteristics, it requires people with strong customer service orientation, commitment, honesty and general knowledge of sustainability. Production process is complex, it requires spaces of direct customer interaction such as airport picking-up, check in and check-out, service in

⁴² Based on a personal interview to Gustavo Araya C., Board Chief Bonanza Management Team (Hotel Ramada Plaza Herradura, Condohotel Jaco Bay and Anfiteatro Bonanza), and to Gustavo J. Segura, General Manager, Hotel Ramada Plaza Herradura. Costa Rica. 9 Nov. 2009.

restaurants) and areas of non-interaction with customers like maintenance workshops, food buying and preparation, laundry and ironing, among others.

The Board, following a systemic crisis in March 2007, introduced a new CEO. Upon his designation, he started an arduous re-structuring process and strategic reorientation.

The whole process was based on the following:

1. Values: redefining organizational values, rethinking of their mission and vision, among other actions;
2. Physical re-structuring and energy: rooms, restaurants and public areas remodelling, boilers, laundry, lighting technology changes towards energy efficiency ones;
3. Promotion and marketing: aggressive publicity campaign to increase the hotel appearance on television.

Certificate in Sustainable Tourism (CST)

The company obtained a CST, Level 3, a distinction granted by the Ministry of Tourism, the Costa Rican Institute of Tourism, due to its efforts towards a broader policy of social and energy transformation.

Within the re-structuring process, two programs have served as a "platform" to achieve the hotel sustainability goals: the CST (which was awarded in 2007)⁴³ and the Corporate Social Responsibility Program (Award for Merit in Tourism 2009-2010 of the National Chamber of Tourism – CANATUR). Normally aggressive companies that initiate CSR programs or join the CST are financially healthy companies. Companies under this scheme have used this platform to get rid of a crisis.

The platform has enabled savings for more than US\$50,000 a month. Also, the CSR provides motivation to staff and attracts new accounts to the company, particularly for multinational corporations seeking similar business partners. The Corporate Social Responsibility Tourism Award 2009-2010 from CANATUR has helped to reinforce the aforementioned aspects.

Greening labour market and education system

The hotel's general manager received a Masters in the Administration of Natural Resources (MARN)⁴⁴ at the INCAE Business School when this program was offered. In addition to courses on Business Administration, this training provided skills development in

- Administration of Protected Areas
- Energy and Natural Resource Administration

⁴³ The CST Program is a product of the Costa Rican Tourism Institute (ICT). More information is available at: <http://www.turismo-sostenible.co.cr/EN/sobreCST/about-cst.shtml>

- Sustainable Economic Development
- Natural Resource Economics and Contaminations
- Project Evaluation and Environmental Impact
- Natural Resource Policy, Legislation and Planning

The hotel's manager credits this training to broadening his vision for the hotel's administration, as this enabled him to inspire and lead changes at the hotel for energy efficiency and sustainability, the CST certification, and efforts in corporate responsibility.

The company now wishes to recruit a manager to supervise CSR and sustainability issues. In addition, working committees have been created internally for CSR topics, namely Sustainability and Occupational Health. The hotel administration hired an administrative assistant for the General Manager as well as a Human Resource manager, both of whom also received training in CST.

According to the general manager, Costa Rica's labour market has few people available with expertise in sustainability, but it is possible to find them. Some companies are providing consulting services in this topic, but for specific projects. For companies such as Ramada Plaza Herradura, in which competitive strategy is based upon sustainability, it is required to provide their own team of experts in order to succeed in the market.

The Ramada Plaza Herradura has agreements with several universities and INA for internships and professional practice. This gives the Hotel the opportunity to identify and train people interested in pursuing careers in sustainability hotel and services. This was the case of the assistant for the General Manager. She spent five months doing an internship that led them to identify opportunities for improvement in order to get a better score in the CST audit. She holds a bachelor degree in Tourism⁴⁵.

The Government role supporting sustainability initiatives is mostly through policy. As previously stated, the Costa Rican Tourism Institute (ICT) is in charge of provide the certification for sustainable tourism.

The hotel is attending international fairs to promote tourism with preferential rates. Also, it has received certain privileges due to its certification. These efforts comprise part of their promotion and marketing campaign. In terms of operating costs, they have not received further support. Government lacks a policy of incentives to promote cleaner and more efficient technologies.

The Hotel CEO holds the position of Vice-President of the Costa Rican Chamber of Hotels. He has done numerous lectures, conferences and meetings to discuss the benefits of the sustainability strategy. Also, the Hotel staff visits activities organized by the Chamber. This provides an additional option for training

⁴⁵ Both the new HR Manager and the administrative assistant to the General Manager, required knowledge and experience in CST as conditions for entry into the payroll of the hotel. This was the only addition to the normal requirement for both positions.

the staff members to examine ways they can make changes to their current positions.

Conclusions

The aforementioned actions have led to a change in organizational culture at the Ramada Plaza Herradura. This started in 2007 under the new set of organizational values and has been reinforced by the efforts of a general manager who developed his skills set in such a way that he was able to look at the hotel industry in a different way. His actions have had spill over effects and changed requirements for other jobs, such as those of his assistant and the new Human Resources (HR) manager.

Additionally, there have been numerous roundtables about integrity, customer service, sustainability and the new company strategy. The concepts have been included in the processes of induction to new staff. Training actions, specifically directed to their staff, have yielded a positive impact for the company and also the community.

The Hotel sector is demanding human resources with knowledge of sustainability. Travelocity, for example, has just launched a website with certified sustainable tourism products (hotels, tours) which has grown at very high rates within months. All companies will be incorporating certification processes and will be adopting sustainable practices; human resources will need to change their profiles and personal skills.

4. Conclusions

4.1 Main 'greening' shifts in economies and labour markets

The creation of the Costa Rican green economy is unmistakably underway. The nation's incipient efforts at targeted areas such as renewable energy development, ecotourism and natural resource management have set the course for more widespread efforts in other industries and sectors. International policy changes and cooperation efforts such as The Kyoto Protocol and the United Nations Climate Change Conference 2009 in Copenhagen have created the need for new national policies and strategies, answered in part by President Oscar Arias's plan to make the country carbon neutral by 2021. This has, in turn, brought about initiatives such as the Peace with Nature Initiative and the National Climate Change Strategy; initiatives which have inspired responses from the academia, the private sector, and different public sector organizations.

Focus group participants pointed to a shift in the Costa Rican and international markets – consumers interested in more organic products and green processes, and noted that these consumers have created the demand and the market for such products, thus triggering the need for the supply to meet this demand. The business case for greening has therefore provided the incentive for the requisite changes and corporate responsibility, the result of which has led to a patchwork of individual greening efforts in response to both the market and government policies; a response which still lacks cohesiveness and an integrated strategy. There are newly emerging opportunities in Costa Rica for new green jobs and greening

existing positions, yet many of these are yet to be identified conclusively, however the labour market has already begun to respond.

4.2 Skills implications and development greening

4.2.1 *Anticipation and identification of skill need*

The anticipation and identification of skill needs are still ad hoc and based either on the interests of company or public sector management, or in response to established policies. As the cases have demonstrated, in some instances the companies have identified goals such as becoming carbon neutral, and then worked backwards in response to such a goal.

- What does it mean to become carbon neutral? How does one become carbon neutral?
- What changes should be implemented and/or what equipment is needed for this shift?
- Which professional should be responsible for overseeing and implementing this change?
- What skills set should this person already possess or need to develop?
- How can this person develop their skills set? Are there organizations, institutions and certifications established?
- Can these skills and knowledge be transferred to other members of the organization?

These questions reflect the current governing method of skills identification, however a more macro response at the national level needs to be developed. The opportunity exists for more coordination and involvement from the Ministry of Labour, the Ministry of Economy Industry and Commerce, and the Ministry of Public Education, for example, to establish systematic information exchange across the different sectors regarding the employment opportunities and skills gaps which exist particularly as it refers to the creation of green jobs.

4.2.2 *Response policies and programmes*

As noted in Section 2, Costa Rica has a strong history of the creation of environmentally conscious policies to ensure a future with sustainable development. However, there is still a need for some concrete response policies and programmes which directly target the creation of the green jobs. These policies include the creation of one national body to oversee and report data on greening, job creation, skills needs and progress. National indicators have an important role to play in monitoring and recording the country's efforts. Focus group participants also pointed to the need to ensure that an appropriate national curriculum is developed to educate across educational levels. International interest in climate change and greenhouse gas emissions provides new opportunities for Costa Rica to seek cooperation from other international organizations and other countries to help streamline the process of identification and response to labour market needs

5. Recommendations

While Costa Rica's government has been proactive at creating policies and programs such as the National Climate Change Strategy and the Peace With Nature Initiative, there still exists opportunities for the creation of additional policies and educational programs to ensure that the country's goals are realized. Among these policy recommendations are:

5.1 Policy recommendations

- Establishment of a national body to oversee the creation of a green economy. This entity should gather and report all national data on greening, including job creation, skills needs, training opportunities and progress. This entity may perhaps be linked directly to the National Climate Change Strategy and be overseen by several ministries including the MINAET, MEP, Ministry of Planning, the Ministry of Labour, the Presidency, and others.
- Establishment of national indicators. These indicators would better assist the government and other actors with the design and implementation of effective strategies to educate students, professionals and the wider society and prepare for participation in the green economy.
- Given the international interest in carbon neutrality and sustainable development, as well as the advances in other countries such as Germany, international cooperation at the sovereign and sub-sovereign levels could be promoted so as to examine best practices and benchmarks and implement adjusted strategies.
- It has been mentioned that government bureaucracy and monopoly hampers innovation, particularly in the area renewable energy. The government should devise mechanisms to incentivize research, technology and innovation in greening by reducing some of its barriers and bureaucracy, providing tax breaks and encouraging investment in green sectors.

5.2 Recommendations for education and training

- Costa Ricans believe that it is necessary for education efforts to be targeted at primary and secondary education, as the youth are the future of the society. Focus group participants felt that all students, regardless of career track, must understand the implications of environmental management in their chosen field, so as to better prepare the future professionals for new green collar occupations and the greening of existing jobs.
- It is essential that skills responses be multidisciplinary to ensure that professionals have both the knowledge and technical skills to perform their job functions appropriately.
- Currently there is no standard for curriculum development regarding specific education requirement at the different levels or how this should be achieved. The MEP should therefore design and implement a comprehensive education curriculum to help standardize the information taught to students around the country.
- As demonstrated in earlier sections, many of the skills development opportunities exist at the tertiary level, particularly at universities. More vocational programs must be developed to target persons with lower

educational attainment and at the high school level to ensure that greening is not elitist and does not exclude persons with lower formal education formation.

- The creation of a national fund for green education would be instrumental for assisting institutions and the private sector, particularly SMEs, with training opportunities for their staff in sustainable development policies and practices. This fund would offset costs and encourage more conventional organizations to become informed and involved.
- Design and implementation of a mechanism for dialogue between the government, academia, private sector and civil society regarding the state of the green economy, needs and gaps, and responses to ensure that needs are identified and met in a systematic manner. This will also assist in projections and strategy development for the short and long term.
- Develop a national program of precision agriculture driven by a governmental institution. The Instituto Nacional de Tecnología Agropecuaria (INTA) in Argentina, the Empresa Brasileira de Pesquisa agropecuária (EMBRAPA) in Brazil and Instituto de Investigaciones Agropecuarias (INIA) in Chile are leading examples institutions working on the topic with currently implemented projects. Costa Rica may benefit from this type of initiative, which will promote research and outreach in main economic value crops, enhancing productivity and improving the utilization of inputs like herbicides, fungicides and fertilizers.
- Public and private universities need to develop courses in precision agriculture, addressing important topics as data acquisition and utilization. For instance, only in the United States, nearly 15-20 universities are teaching precision agriculture as part of their curricula. Also, approximately ten Brazilian institutions are also training professionals in this topic.
- The government should promote technology transfer with the developers of instruments and equipment and facilitate their access to the country. It is important to facilitate the flow of technical knowledge to farmers and technicians in order to maximize the proper use of existing technologies.
- Instituto Nacional de Aprendizaje (INA) should develop a training course for data collection. Private sector has pointed out the need to form technicians specialized in data collection. Currently there is a lack of this type of technicians in the country; since most of data collectors are formal trained professionals like engineers.
- Salaries must be re-defined since current payment for professional working in the area is low compared to other jobs. Several interviewed persons addressed payment as one of main barriers leading to the scarce number of specialized precision agriculture professionals working in high economic value crops in Costa Rica. It was mentioned that current paid salaries are very low and must be increased in order to elevate the number of professionals willing to acquire knowledge in precision agriculture.

5.3 Recommendations for further research and data collection

- It may be useful to conduct a comprehensive survey at the national level to determine the extent to which green jobs currently exist in Costa Rica, the interest in greening, and the skills response thus far. This research may be added to a national census to ensure proper scope and reach.

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Organization/Institution

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Coalición Costarricense de Iniciativas del Desarrollo (CINDE)

Estrategia Nacional de Cambio Climático (ENCC)

The Certification in Sustainable Tourism Program (CST)

Green Jobs: Facing up (ILO)

The UNEP-ILO Green Jobs Initiative (UNEP-ILO)

Cámara de Industrias de Costa Rica (CICR)

Colegio Federado de Ingenieros y Arquitectos (CFIA)

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<http://www.cfia.or.cr/quienes.htm>

Annexes

Annex A.1. Focus groups participants

Company	Name	Position
Florex	Sylvia Elena Chaves	Vice-President
Cámara de Industrias	Kenlly Alfaro Ugalde	Legal Advisor
INCAE Business School	Giannina Bontempo	Coordinator for Internal Projects on Energy and Natural Resources
INCAE Business School	Bernard Killian	Professor
Empresario Turístico	Carlos Alberto López	Tourist Guide
FONAFIFO	Alberto García Arguedas	International Affairs Professor. Environmental Services Marketing Department
E+Co. Capital	Andrea Borel	Monitoring and Evaluation Specialist
Centro de Inteligencia sobre Mercados Sostenibles CIMS	Kira Schröder	Operations Coordinator
E+Co. Capital	Andrea Borel	Monitoring and Evaluation Specialist
Ministerio de Medioambiente	Vianney Loaiza Camacho	
Enlace	Roberto Cordero	Environmental Law Specialist
Mesoamerica Energy	Leonel Umana	Business Developer
Sipcomgreen	Jorge Serendero	
SENARA	Sonia Castro Chacon	Basins and Water Resources management Specialist
PRUGAM	Eduardo Brenes	Director
INCAE	Edwin Vega	Consultant
Instituto Nacional de Aprendizaje	Gloria Elena Acuña	Materials Technology Core Manager
Instituto Nacional de Aprendizaje	Paula Chaves	Technology Processes Manager
Colegio Tuetal	Evelyn Vega Ruiz	Tourism Teacher
InBio	Javier Rodriguez	
Purdy Motors	Luis Maestroeni	Communications and CSR Manager
EARTH	Manrique Arguedas C.	Rational Use of Resources Program

Annex A.2. Case Study and Research Interviews

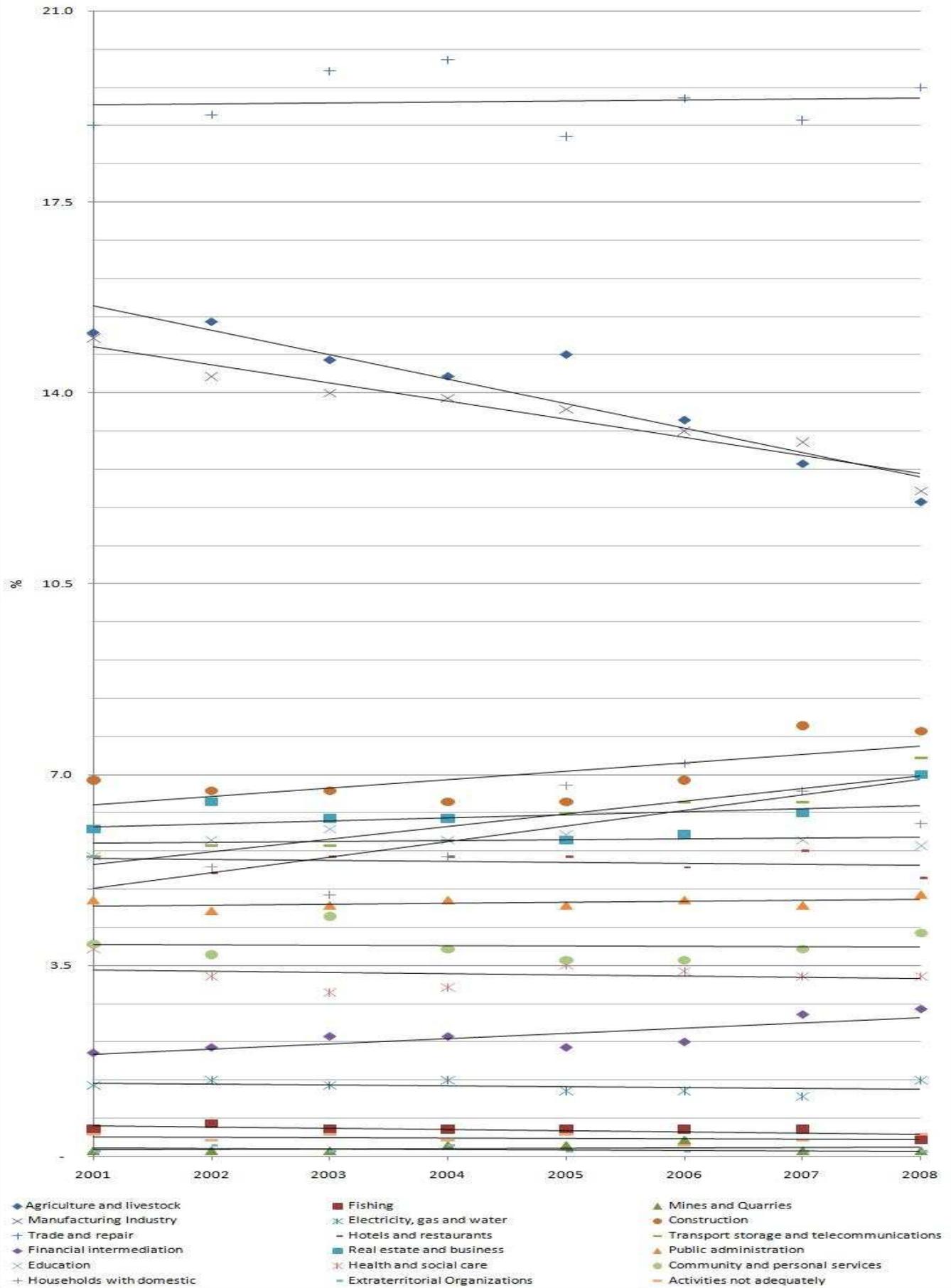
Company	Name	Position
Intel Components	Aníbal Alterno	Occupational Health and Safety Manager
Dole Costa Rica	Rudy Amador	Director of Corporate Social Responsibility
Hotel Ramada Plaza Herradura	Gustavo Araya	Chief of Board – Bonanza Management Team
COFERENE	Maria Teresa Arguedas	Coordinator
INCAE Business School	Giannina Bontempo	Coordinator – Internal Projects on Energy and Natural Resource Management
	Fabio Chaves	Rice producer
AGRIPRESA	Jose Francisco Corella	Manager
EARTH University	Marco Davila	Student
Peace with Nature Initiative	Pedro Leon	General Coordinator
Operating Consortium of the East, S.A. (COESA)	Eladio Madriz	General Coordinator
Purdy Motor Group	Luis Maestroni	Communications and CSR Manager
PRUGAM	Eduardo Mata Brenes	Project Director
Earth University	Luis Navarro	Waste Manager
INCAE Business School	Juan Manuel Ortega	Coordinator – Internal Projects on Energy and Natural Resource Management
Instituto Nacional de Aprendizaje	Carlos Sanchez	Skills Developer, Materials Technology Core, Environmental Management Subsector
Ramada Plaza Herradura	Gustavo Segura	General Manager
EARTH University	Oswaldo Urgiles	Student

Annex B. Economic activity participation (persons aged 12 and over)

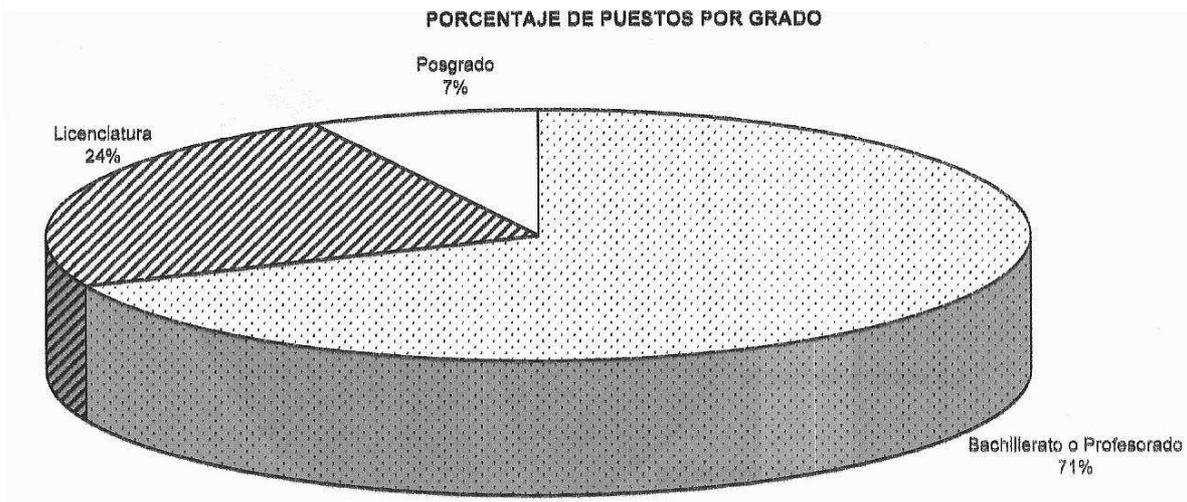
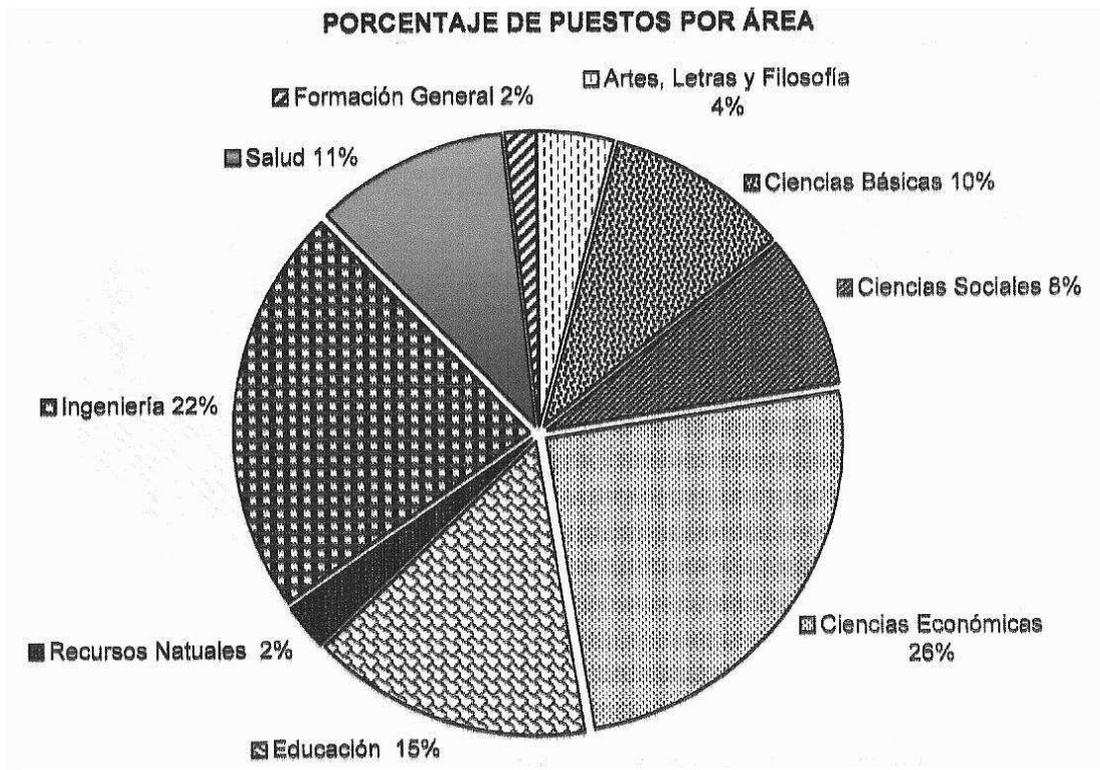
Economic activity	2001	2002	2003	2004	2005	2006	2007	2008
Agriculture and livestock	15.1	15.3	14.6	14.3	14.7	13.5	12.7	12.0
Fishing	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.3
Mines and Quarries	0.1	0.1	0.1	0.2	0.2	0.3	0.1	0.1
Manufacturing Industry	15.0	14.3	14.0	13.9	13.7	13.3	13.1	12.2
Electricity, gas and water	1.3	1.4	1.3	1.4	1.2	1.2	1.1	1.4
Construction	6.9	6.7	6.7	6.5	6.5	6.9	7.9	7.8
Trade and repair	18.9	19.1	19.7	19.9	18.7	19.2	19.0	19.3
Hotels and restaurants	5.5	5.2	5.5	5.5	5.5	5.3	5.6	5.1
Transport storage and telecommunications	5.5	5.7	5.7	5.8	6.3	6.5	6.5	7.3
Financial intermediation	1.9	2.0	2.2	2.2	2.0	2.1	2.6	2.7
Real estate and business	6.0	6.5	6.2	6.2	5.8	5.9	6.3	7.0
Public administration	4.7	4.5	4.6	4.7	4.6	4.7	4.6	4.8
Education	5.5	5.8	6.0	5.8	5.9	5.9	5.8	5.7
Health and social care	3.8	3.3	3.0	3.1	3.5	3.4	3.3	3.3
Community and personal services	3.9	3.7	4.4	3.8	3.6	3.6	3.8	4.1
Households with domestic	4.9	5.3	4.8	5.5	6.8	7.2	6.7	6.1
Extraterritorial Organizations	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1
Activities not adequately	0.4	0.3	0.4	0.3	0.4	0.2	0.3	0.4

Source: National Institute of Statistics and Censuses. <http://www.inec.go.cr/>

Trends in percentage share of employment by Industry

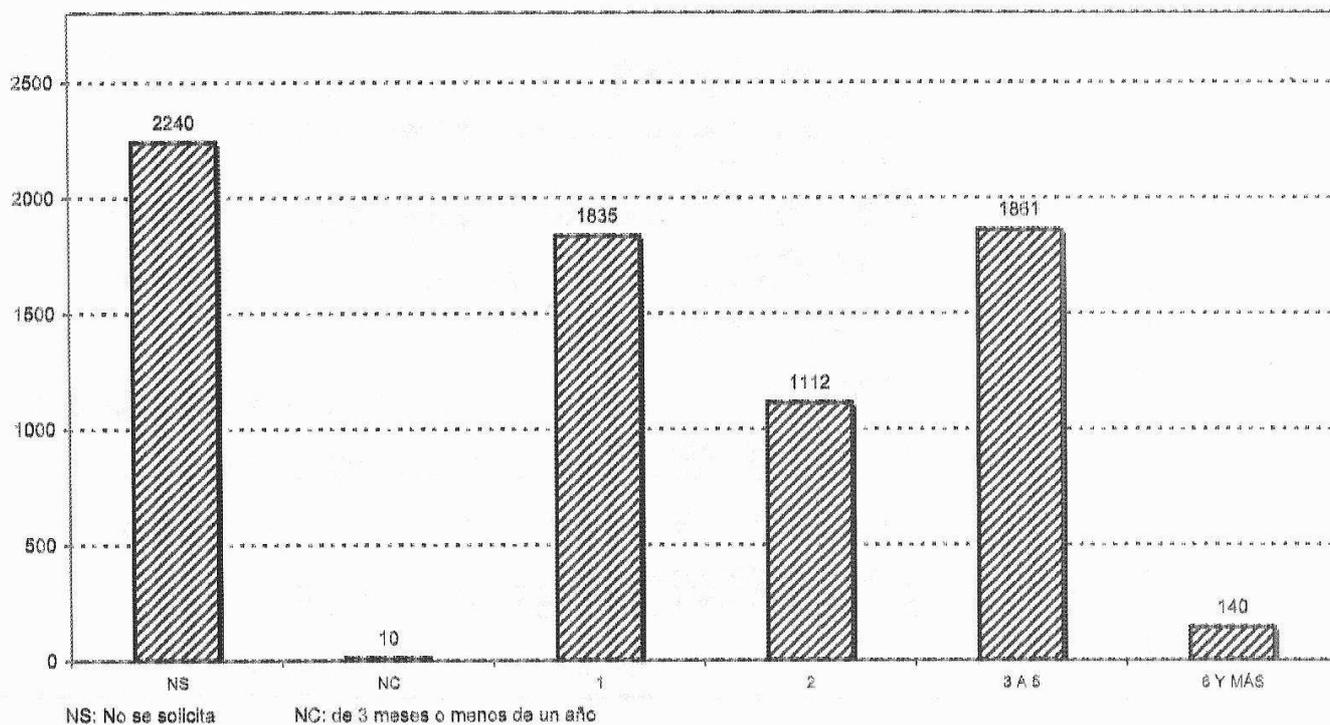


Annex C. Jobs share by field, grade, years of experience, and required experience

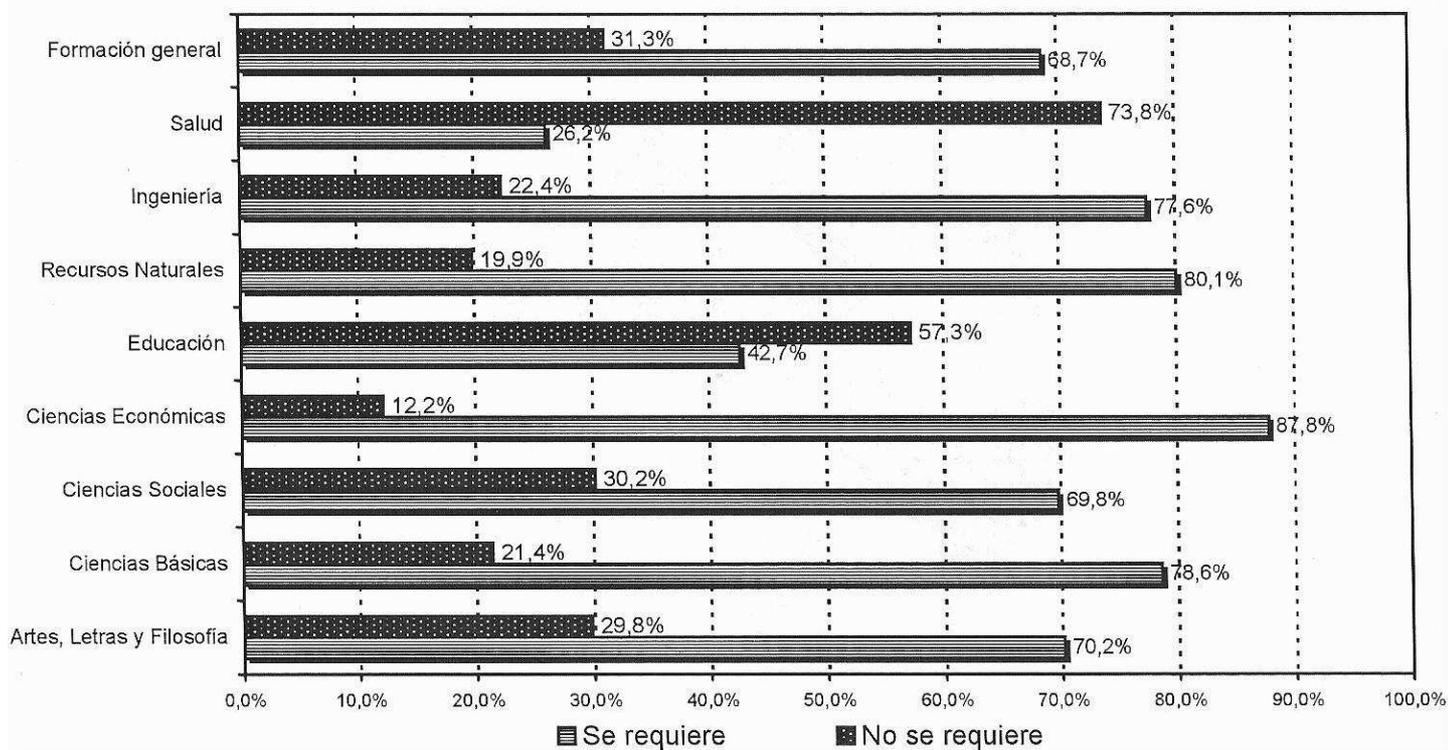


Taken from Cabrera, 2008.

NÚMERO DE PUESTOS POR AÑOS DE EXPERIENCIA



PORCENTAJE DE PUESTOS POR ÁREA SEGÚN SI SE REQUIERE EXPERIENCIA



Annex D. Greening programs offered by registered higher education institutions, classified by grade and public or private status

Career	Grade	University	1- Public / 0-Private
“Los Biorreactores El Puente del Laboratorio a la Tierra”	Curso Libre	CATIE	0
Adaptación al cambio climático: el rol de los servicios ecosistémicos	Curso Libre	CATIE	0
Agricultura Ecológica	Maestría	CATIE	0
Agricultura Ecológica con énfasis en Recursos Fitogenéticos y Biotecnología		CATIE	0
Agricultura Tropical	Doctorado	CATIE	0
Agroecología Tropical	Curso Libre	CATIE	0
Agroforestería Tropical	Maestría	CATIE	0
Análisis Estadístico de Datos e Interpretación de Resultados	Curso Libre	CATIE	0
Bases Económicas e Institucionales para la Gestión y la Valoración de Servicios Ambientales	Curso Libre	CATIE	0
Cacaocultura Moderna	Diplomado	CATIE	0
Ciencias Forestales Tropicales	Doctorado	CATIE	0
Datos Multivariados: Análisis Clásicos y Nuevas Tecnologías	Curso Libre	CATIE	0
Desarrollo Empresarial Rural	Diplomado	CATIE	0
Diseño de Actividades REDD para la Mitigación del Cambio Climático	Curso Libre	CATIE	0
Diseño de Proyectos MDL en los Sectores Forestal y Bioenergía	Curso Libre	CATIE	0
Forestería Análoga	Curso Libre	CATIE	0
Forestería en Zonas Tropicales y Subtropicales	Doctorado	CATIE	0
Ganadería Ambiental y Herramientas para la Certificación de Fincas Sostenibles	Curso Libre	CATIE	0
Gerencia y Liderazgo para el Manejo y Gestión de Cuencas	Curso Libre	CATIE	0
Gestión Comunitaria en Áreas Protegidas, Zonas de Amortiguamiento y Corredores Biológicos	Curso Libre	CATIE	0
Gestión de Riesgo y Cambio Climático	Curso Libre	CATIE	0
Gestión del Riesgo y Adaptación al Cambio Climático en América Latina: Tendencias y Desafíos	Curso Libre	CATIE	0
Gestión Integral de Cuencas Hidrográficas	Curso Libre	CATIE	0
Implementación de Sistemas Silvopastoriles y Buenas Prácticas Ganaderas como una Herramienta para la Mitigación y Adaptación al C C en el Trópico	Curso Libre	CATIE	0
Socioeconomía Ambiental	Maestría	CATIE	0
Manejo de Cuencas y Cambio Climático	Curso Libre	CATIE	0
Manejo Diversificado de Bosques Naturales Tropicales	Curso Libre	CATIE	0
Manejo y Conservación de Bosques Tropicales y Biodiversidad	Maestría	CATIE	0
Manejo y Conservación de Bosques Tropicales y Biodiversidad con énfasis en Conservación de la Biodiversidad		CATIE	0
Manejo y Conservación de Bosques Tropicales y Biodiversidad con énfasis en Manejo y Silvicultura de Bosques		CATIE	0
Manejo y Gestión Integral de Cuencas Hidrográficas	Maestría	CATIE	0
Metodologías y Estrategias de Extensión para el Desarrollo Rural Sostenible	Curso Libre	CATIE	0
Modelos de Simulación para la Evaluación de Estrategias de Alimentación de Ganado de Doble Propósito Manejado Bajo Sistemas Silvopastoriles	Curso Libre	CATIE	0

Career	Grade	University	1- Public / 0-Private
Planificación para el Manejo de Cuencas	Curso Libre	CATIE	0
Seminario Móvil Internacional - Manejo de áreas Protegidas	Curso Libre	CATIE	0
Sistemas Agroforestales	Doctorado	CATIE	0
Sistemas de Información Geográfica Aplicados a la Ecología de Paisajes con énfasis en Corredores Biológicos	Curso Libre	CATIE	0
Socioeconomía Ambiental con énfasis en Administración y Gerencia Ambiental		CATIE	0
Socioeconomía Ambiental con énfasis en Economía y Sociologías		CATIE	0
Empresas y Actividades Turísticas	Diplomado	Colegio Universitario de Cartago	0
Prácticas sostenibles en Ingeniería Ambiental	Diplomado	EARTH	0
Promoviendo la Sostenibilidad	Diplomado	EARTH	0
Sostenibilidad de Agroecosistemas Tropicales	Diplomado	EARTH	0
Agroecoturismo	Diplomado	ECAG	0
Manejo Forestal y Vida Silvestre	Diplomado	ECAG	0
Desarrollo Económico Local con énfasis en Turismo Comunitario	Maestría	FLACSO	0
Auditoría Ambiental	Curso Libre	ICAP	0
Evaluación de Impacto Ambiental para Proyectos	Curso Libre	ICAP	0
Gerencia de Proyectos de Desarrollo	Maestría	ICAP	0
Gestión Ambiental Municipal en el marco de la Agenda Local 21	Diplomado	ICAP	0
Gestión de Riesgo para Proyectos	Curso Libre	ICAP	0
Gestión Integral de Residuos Sólidos	Curso Libre	ICAP	0
Forestales y Ambiente	Técnico	INA	1
Gestión Ambiental	Técnico	INA	1
Gestión Empresarial para el Sector Agropecuario	Técnico	INA	1
Tecnologías de Suelos y Aguas	Técnico	INA	1
Ecobanking	Curso Libre	INCAE	0
Master of International Agribusiness Management - MIAM	Maestría	INCAE	0
Programa de Coherencia de Políticas Públicas para el Desarrollo Sostenible	Curso Libre	INCAE	0
Programa de Gerencia de la Sostenibilidad	Curso Libre	INCAE	0
Fundamentos de Turismo	Curso Libre	Instituto de Tecnología Administrativa	0
Legislación Turística	Curso Libre	Instituto de Tecnología Administrativa	0
Ciencias Naturales para el Desarrollo	Doctorado	ITCR	1
Ciencias Naturales para el Desarrollo con énfasis en Gestión de Recursos Naturales	Doctorado	ITCR	1
Ciencias Naturales para el Desarrollo con énfasis en Gestión y Cultura Ambiental	Doctorado	ITCR	1
Ciencias Naturales para el Desarrollo con énfasis en Sistemas Agropecuarios Alternativos	Doctorado	ITCR	1
Gestión del Turismo Rural Sostenible	Bachillerato	ITCR	1
Gestión del Turismo Sostenible	Bachillerato	ITCR	1
Ingeniería Agrícola	Bachillerato	ITCR	1
Ingeniería Agrícola	Licenciatura	ITCR	1

Career	Grade	University	1- Public / 0-Private
Ingeniería Agropecuaria Administrativa	Bachillerato	ITCR	1
Ingeniería Agropecuaria Administrativa	Licenciatura	ITCR	1
Ingeniería Ambiental	Licenciatura	ITCR	1
Ingeniería en Agronomía	Licenciatura	ITCR	1
Ingeniería en Biotecnología	Bachillerato	ITCR	1
Ingeniería Forestal	Diplomado	ITCR	1
Ingeniería Forestal	Bachillerato	ITCR	1
Ingeniería Forestal	Licenciatura	ITCR	1
Turismo	Bachillerato	UACA	0
Turismo	Licenciatura	UACA	0
Administración de Áreas Protegidas	Bachillerato	UCI	0
Gestión del Turismo Sostenible	Maestría	UCI	0
Legislación Ambiental	Maestría	UCI	0
Agronomía	Bachillerato	UCR	1
Agronomía	Licenciatura	UCR	1
Agronomía	Diplomado	UCR	1
Biología	Bachillerato	UCR	1
Geología	Bachillerato	UCR	1
Geología	Licenciatura	UCR	1
Ingeniería Agrícola	Bachillerato	UCR	1
Ingeniería Agrícola	Licenciatura	UCR	1
Meteorología	Bachillerato	UCR	1
Meteorología	Licenciatura	UCR	1
Turismo Ecológico	Bachillerato	UCR	1
Turismo Ecológico	Licenciatura	UCR	1
Turismo con énfasis en Ecoturismo	Bachillerato	UIA	0
Turismo con énfasis en Ecoturismo	Licenciatura	UIA	0
Biología con énfasis en Ecología y Desarrollo Sostenible	Bachillerato	ULATINA	0
Biología con énfasis en Ecología y Desarrollo Sostenible	Licenciatura	ULATINA	0
Turismo con énfasis en Administración de Empresas Turísticas	Bachillerato	ULATINA	0
Biología Marina	Bachillerato	UNA	1
Biología Marina	Licenciatura	UNA	1
Biología Tropical	Bachillerato	UNA	1
Biología Tropical	Licenciatura	UNA	1
Biotecnología	Bachillerato	UNA	1
Desarrollo Sostenible y Economía Ecológica		UNA	1
Enseñanza de las Ciencias con Concentración en Biología Ambiental	Profesorado	UNA	1
Enseñanza de las Ciencias con Concentración en Biología Ambiental	Bachillerato	UNA	1
Enseñanza de las Ciencias con Concentración en Biología Ambiental	Licenciatura	UNA	1
Ingeniería Agronómica	Bachillerato	UNA	1
Ingeniería Agronómica	Licenciatura	UNA	1

Career	Grade	University	1- Public / 0-Private
Agroindustria	Bachillerato	UNED	1
Agroindustria	Licenciatura	UNED	1
Ingeniería Agronómica	Bachillerato	UNED	1
Ingeniería Agronómica	Licenciatura	UNED	1
Manejo y Protección de Recursos Naturales	Bachillerato	UNED	1
Manejo y Protección de Recursos Naturales	Licenciatura	UNED	1
Producción y Comunicación Agropecuaria	Bachillerato	UNED	1
Producción y Comunicación Agropecuaria	Licenciatura	UNED	1
Planning, Monitoring and Evaluating Agroforestry Projects	Curso Libre	Universidad de la Paz	0
Tools for Sustainable Development of Forestry Resources	Curso Libre	Universidad de la Paz	0
Administración Turística	Licenciatura	Universidad de La Salle	0
Gestión Turismo Ecológico	Bachillerato	Universidad del Turismo de Costa Rica	0
Turismo	Bachillerato	Universidad Florencio del Castillo	0
Turismo	Licenciatura	Universidad Florencio del Castillo	0
Turismo	Bachillerato	Universidad Hispanoamericana	0
Turismo con énfasis en Ecoturismo	Bachillerato	Universidad Hispanoamericana	0
Turismo con énfasis en Ecoturismo	Licenciatura	Universidad Hispanoamericana	0
Gerencia Hotelera y Empresas Ecoturísticas	Bachillerato	Universidad Internacional San Isidro Labrador	0
Gerencia Hotelera y Empresas Ecoturísticas	Licenciatura	Universidad Internacional San Isidro Labrador	0
Liderazgo y Gerencia Ambiental	Maestría	Universidad para la Cooperación Internacional	0
Guías en Turismo	Diplomado	Universidad Técnica Nacional - Sede Pacífico	0
Guías en Turismo	Bachillerato	Universidad Técnica Nacional - Sede Pacífico	0
Analysis and Design of Natural Resources Policies		Universidad de la Paz	0
Ciencias Naturales para el Desarrollo	Doctorado	UNED	1
Derecho Agrario y Ambiental	Especialización	UCR	1
Desarrollo ético-empresarial	Postgrado	EARTH	0
Desarrollo sostenible con énfasis en Formación y Promoción Ecológica y Conservación de los Recursos Biológicos	Postgrado	UCR	1
Environmental Conflict Management		Universidad de la Paz	0
Gestión de Proyectos de Ecoeficiencia y Hábitat Sustentable	Curso Libre	UCI	0
Good Management of Natural Resources y Central America	Curso Libre	Universidad de la Paz	0
Maestría académica en Ciencias agrícolas y RR.NN. con énfasis en protección de	Maestría	UCR	1

Career	Grade	University	1- Public / 0-Private
cultivos y suelos			
Maestría Académica en Gestión Ambiental y Ecoturismo	Maestría	UCR	1
Maestría Académica en Gestión Integrada de Areas Costeras Tropicales	Maestría	UCR	1
Maestría Académica en Hidrogeología y Manejo de los Recursos Hídricos	Maestría	UCR	1
Maestría Académica en Manejo de RRNN (mención en Gestión Ambiental)	Maestría	UNED	1
Maestría Académica en Manejo de RRNN (mención en Gestión de la Biodiversidad)	Maestría	UNED	1
Maestría Académica y Profesional en Gestión Ambiental y Ecoturismo	Maestría	UCR	1
Maestría en Desarrollo Económico Local con énfasis en Turismo Comunitario	Maestría	FLACSO	0
Maestría en Legislación Ambiental	Maestría	UCI	0
Maestría en Liderazgo y Gerencia Ambiental	Maestría	UCI	0
Maestría en Política Económica	Maestría	UNA	1
Maestría profesional en Desarrollo Integrado de Regiones bajo Riesgo	Maestría	UCR	1
Maestría Profesional en Gestión de Areas Protegidas y Desarrollo Ecoregional	Maestría	UCI	0
Manejo sostenible de recursos naturales	Postgrado	CATIE	0
Master of Arts Degree Programme in Natural Resources and Peace	Maestría	Universidad de la Paz	0
Master of Arts Degree Programme in Responsible Management and Sustainable Economic Development (RMSED)	Maestría	Universidad de la Paz	0
Master on environmental Security and Peace	Maestría	Universidad de la Paz	0
Nuevas tendencias del comercio agropecuario	Postgrado	EARTH	0
Producción sostenible de la agro empresa	Postgrado	EARTH	0
Programa de Formación de Consultores Ambientales	Curso Libre	INCAE	0
Sistemas de Producción Agrícola Tropical Sostenible	Doctorado	UCR	1
The Master of Arts Dual degree in Natural Resources and Sustainable Development programme	Maestría	Universidad de la Paz	0
Total Master's, undergraduate and postgraduate	58	Total Programs	163
Total Doctorates	10	Total Public Institutes Programs	64
Total Baccalaureate, Diploma, technicians and Specializations	50	Total Private Institutes Programs	99
Total free courses	37		
Blank	8		

Annex E. Detailed course content as part of Dole's Training Program

- Agrochemicals Safety Management
- Management System Administration
- Occupational Health Module
- Air Fumigation Module
- Operation of Aerial Fumigation Plants Module to Supervisors
- Operation of Aerial Fumigation Plants Module to Plant Personnel
- Forklifts Operation
- Natural Resources Management
- Emergencies care
- Environmental Management and Safety in Food Processing Activities
- Environmental Management Introduction
- Prevention and Fire Fighting
- First Aid
- Global GAP Norm (Good Agriculture Practices)
- Monitoring and Tracking of Environmental Management
- Agrochemicals storage rooms Operation
- Integrated Systems Management
- HACCP Principles Course
- Audit CO2 Seminar (ISO 14064-14065)
- Social Responsibility Audit
- Occupational Health Commission Training
- Tesco-Primus Lab Course
- Chemical Products (toxic and hazardous) Management
- Social Responsibility System
- Auditor CO2 Course
- Water Forum
- Social Responsibility according to SA8000

Annex F. Detailed Precision Agriculture course content at EARTH University

1. Introduction to precision agriculture
2. Precision agriculture needs
3. Spatial variability
4. Geographic information systems
5. Introduction to global positioning systems
6. Global Positioning Systems (GPS) differential correction
7. Descriptive statistics
 - a. Geographic information systems laboratory
8. Spatial variability quantification
9. Strategies of soil sampling in precision agriculture
10. Precision agriculture research
11. Specific site nutrient management
 - b. Field practice and geographic information systems laboratory
12. Spatial resolution determination
13. Sensors on the march
14. Management zones
15. Precision agriculture in pests and diseases
16. Precision agriculture in weed management
17. Precision agriculture in irrigation
18. Precision agriculture in drainage
19. Sensors technology in precision agriculture
20. Satellites management
21. Production physiology –photosynthesis–
22. Production physiology –carbon fixation, transportation and partition–
 - c. Field trip
23. Simulation models of crops growth and precision agriculture
24. Variable sowing in precision agriculture
25. Yields barriers
26. Mapping of crop yields
27. Variable land application
28. Variable air application
29. Wireless communication
30. Precision agriculture and sustainability
31. Future for precision agriculture
32. Student's research in applied precision agriculture. Selected crops include: coffee, sugar cane, banana, plantain, mango, citrus, corn, grasses, peanut, oil palm, cassava, tobacco, sunflower, rice, ornamental, greenhouses, tomato, onion, garlic and others.