



Guidelines for establishing audits of agricultural– environmental hotspots



Environment and Natural Resources Service
Sustainable Development Department




GUIDELINES FOR ESTABLISHING AUDITS OF AGricultural- ENvironmental hotspots

by

Michael H. Glantz

Environmental and Societal Impacts Group
National Center for Atmospheric Research
Boulder, CO USA



The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

All rights reserved. Reproduction and dissemination of material in this information product for educational or other non-commercial purposes are authorized without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material in this information product for resale or other commercial purposes is prohibited without written permission of the copyright holders. Applications for such permission should be addressed to the Chief, Publishing Management Service, Information Division, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy or by e-mail to copyright@fao.org

© FAO 2003



GUIDELINES FOR ESTABLISHING AUDITS OF AGricultural-ENvironmental (AG-EN) HOTSPOTS

Michael H. Glantz

28 pp, 4 Figures, 1 Appendix, Environment and Natural Resources Working Paper No. 15

ABSTRACT

Starting in 1999, the Food Insecurity and Vulnerability Information and Mapping Systems (FIVIMS) Secretariat in FAO has published an annual report on global Food Insecurity and Vulnerability (see: <http://www.fao.org/DOCREP/005/Y7352E/Y7352E00.HTM>). The report, - *The State of World Food Insecurity*, known as SOFI - assembles, analyses and disseminates information on who are the food insecure, where they are located, and why they are food insecure, nutritionally vulnerable or at risk.

The Environment and Natural Resources Service (SDRN) of the Sustainable Development Department, FAO, has been involved through the preparation of maps and analyses. As food insecurity can often be correlated with difficulties in making proper use of natural resources, it was considered that it would be useful to produce regular analyses about areas where ecological processes or agricultural production are disrupted due to conflicts between environment and agriculture. Such areas are termed agricultural-environmental hotspots, or Ag-En hotspots.

The emphasis is thus on non-optimal functioning of ecosystems, agriculture, or both. "Environment" includes natural, social, economic and cultural aspects.

A brainstorming meeting was organized on 9-10 December 2002 in FAO headquarters to define Ag-En hotspot products that could be prepared based on data availability and on demand, with internal (FAO) and external partners. A discussion paper was prepared in advance by Michael Glantz, Senior Scientist in the Environmental and Societal Impacts Group at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado.

Based on the discussions held at the meeting, Dr Glantz revised the discussion paper, which is presented here as *Guidelines for Establishing Audits of Agricultural-Environmental (Ag-En) Hotspots*.

The report serves multiple objectives, starting with terminology and delineation of concepts. Terms like hotspots, risk, vulnerability, extreme factor, hazard, chronic vs acute hotspots, and the scale at which hotspots are defined demand closer consideration.

Ag-En hotspots themselves can be analysed from twin points of view: first, the mechanisms that cause them, and, second, themes such as soil, water shortage, land degradation, biodiversity, food security (as in FIVIMS),

livelihoods and nutrition.

The following points are also listed among those to which the meeting participants were asked to pay particular attention: monitoring issues, including mapping, thresholds and the possibility of "predicting" future probable hotspots 5 or 10 years ahead; conceptual, causal and thematic links between hotspots, disasters and sustainability; variables and indicators that will be required as a function of an Ag-En hotspot typology, including geographical location, scale, reliability, etc. Appropriate emphasis should be given to non-environmental forcing variables, such as civil unrest, poor resource endowment, and trade.

As mentioned above, the meeting also drew attention to the possibility of identifying mechanisms or patterns that could lead to the development of hotspots in the future, as, for instance, when well-known chronic stresses become acute problems confronting policy-makers.

Keywords: Environment, Impact, Risk, Extreme factor, Prediction, Present futures, Creeping and Environmental Problems.



Contents

ABSTRACT	iii	4 REFERENCES	23
1 INTRODUCTION	1	ANNEX 1 - DECEMBER 2002 BRAINSTORMING AT FAO HQ	
2 CONCEPTS	3	Agenda	25
Overview	3	List of participants	27
How We Tend to Describe Environmental Changes	4		
Syndrome	4		
Dilemma	5		
Paradox	5		
Diagnosis	5		
Potential Indicators to Identify Hotspots	5		
Foreseeability	6		
Defining "Hotspots"	8		
What Should Be the First Steps in a Hotspots Activity?	9		
3 OPTIONS FOR ACTION	11		
Undertake a Hotspots Audit	11		
The interface with relatively fragile environments	13		
WHAT is the Primary Audience for an FAO Ag-En Hotspots Activity?	14		
WHEN to Undertake Hotspot Audits?	14		
WHAT Problems Are Associated with Ag-En Interactions?	14		
Early Warning and Hotspots	16		
HOW to Proceed?	18		
Benefits	18		
Costs	20		
Educational Aspects	20		
A Hotspots Web site	21		
Idea Bank for a Hotspots Web site	22		
Overall Benefits	22		

THE OVERRIDING OBJECTIVES FOR ESTABLISHING A HOTSPOTS ACTIVITY ARE TO AVERT NEW AGRICULTURAL-ENVIRONMENTAL (AG-EN) HOTSPOTS FROM DEVELOPING, AS WELL AS TO BETTER MANAGE EXISTING HOTSPOTS, BEFORE THEY DEGRADE FURTHER INTO ENVIRONMENTAL FLASHPOINTS (I.E., EXTREMELY CRITICAL STAGES OF ENVIRONMENTAL DEGRADATION AND UNWANTED ECOLOGICAL AND SOCIETAL CHANGE). Such an activity provides an additional, reinforcing approach to draw attention to growing concerns about the adverse interplay between human activities related to agriculture and a naturally varying environment (especially climate). It can help to identify and provide early warning about emerging hotspots.

This paper aims to identify key issues related to the purpose and potential value of developing a sustained activity focused on the identification and monitoring of potentially adverse impacts and the responses that might result from interactions between agricultural activities and environmental processes. Where the adverse impacts of such interactions have reached levels detrimental to sustained human activities or to environmental processes, the term "hotspots" is used. The concept of "foreseeability" is introduced and applied to agriculture-environment interactions.



This report approaches the possible development of a multifaceted hotspots activity by posing and then addressing the following basic questions:

- **How** to define the term "hotspots"?
- **What** can be done with respect to hotspots?
- **Why** do we need to do it?
- **Who** might benefit from a hotspots assessment?
- **Who** could undertake the hotspots activity?
- **When** might it begin?
- **How** would the various elements of a hotspots activity be carried out?
- **Whose** responsibility is it to oversee a hotspots programme? Does an organization such as FAO have a responsibility to address the hotspots areas and problems that it identifies and monitors?

Responses to these questions are followed by suggestions about potential indicators, benefits, and costs of a hotspots activity, educational aspects and overall benefits.

OVERVIEW

IT IS NOW WELL KNOWN THAT AGRICULTURAL ACTIVITIES AFFECT AND ARE AFFECTED BY THE QUALITY OF THE ENVIRONMENT ... AND VICE VERSA. Examples are plentiful: an increase in population prompts the movement of new settlement into regions with fragile ecosystems; land that is suitable for grazing livestock is encroached upon by people seeking to find new lands to cultivate; people are moving increasingly into what in the past were probably viewed as either pristine areas in need of protection to maintain biodiversity, or as areas marginal to agricultural production because of the fragility of their vegetative cover, soil structure, highly variable rainfall, or a mismatch between environmental conditions and land-use practices.



Governments have encouraged (or at least not discouraged) many of these migrations into fragile areas. There are scores upon scores of such examples, drawn from the past several decades and from all parts of the globe, and from areas at all levels of economic development, where agriculture-related activities have interacted in adverse ways with environmental processes, often leading to the degradation of both. It is important to note that there are also examples of successful interactions between agriculture and the environment.

Individuals acting on their own will continue, either out of preference or necessity, to seek new areas on which to grow food or graze livestock, as their demand for food and fibre increases.

Assuming that the best rainfed agricultural lands have already been put into production, indirect as well as direct anthropogenic pressures on different ecosystems will undoubtedly continue to increase (Glantz, 1994). The paradox here is that while people (and their governments) seek new lands to cultivate in order to increase food and fibre production, there is considerable evidence to support the view that proper care is not being taken of lands already proven to be agriculturally productive.

It is important to note that every ecosystem (forests, mangroves, inland waters and wetlands, grasslands, arid, marine, coastal, etc.) is at risk from exogenous influences, regardless of whether the causes of those influences are purely natural or anthropogenic, or are a combination of the two. As an example, tracking the findings of desertification studies over the past few decades underscores how difficult it can be to determine long-term consequences of the impacts of desertification processes (Tucker, Dregne and Newcomb, 1991).

Environmental changes can be abrupt or can be of the creeping kind: long term, low grade, slow onset and cumulative. Every change to the natural environment, however slight, could eventually prove to disrupt the sustainability of a specific ecosystem in the long term. Whether an uncontrolled (i.e. runaway) disruption eventually occurs will depend as much on decisions taken by individuals and governments as on natural factors. In many cases, changes to environmental conditions at the interface with human activities cannot be avoided. However, careful monitoring and timely analyses of the changes at this Ag-En interface can lead to appropriate management of those possibly adverse changes. As a result, many of these potentially adverse impacts can be minimized and mitigated, if not prevented.

This is not a new revelation. In a 1955 geography book, Dohrs and colleagues noted (p. 295) that

*Because man **must** eat to survive, and because nearly all of man's food is either directly or*

indirectly a product of the soil, agriculture is one of the most important activities on the earth. ... Shortage of productive land is one of the major problems facing the world, and the development of world agriculture is that of too little land for the rapidly increasing population.

More than a decade later, Borgstrom (1972) coined the term "ghost acres". This notion was used in reference to the amount of land that would have been required to produce an amount of protein equal to that then being extracted from the marine environment. For example, the Japanese diet consisted of large amounts of seafood. Japan would have needed three or more times its then-existing agricultural land in order to compensate or replace the equivalent amount of protein it had been extracting from the sea. That amount of land was and still is not available. In other words, protein retrieved from the sea relieves considerable pressure on land-based resources to produce food.

HOW WE TEND TO DESCRIBE ENVIRONMENTAL CHANGES

Many different terms have been used to identify the way societies perceive the interactions between agricultural activities and environmental processes. Such terms include *syndrome*, *dilemma*, *paradox* and *diagnosis*. Each of these terms seeks to highlight some aspect of the serious attention merited by these interactions.

Syndrome

Researchers at the Potsdam Institute for Climate Impact Research (PIK) are concerned about climate change and human health issues. They refer to an environmental distress syndrome and its health effects. They note their concern about the depletion or disruption of the natural biophysical processes that are the basic sources of sustained good health (Petschel-Held *et al.*, 1999).



Dilemma

Representatives of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have referred to the "productivity-environment" dilemma and the "agricultural intensification" dilemma, noting that "low productivity accelerates degradation and keeps people poor" (see www.icrisat.org). Others have referred to the environment vs jobs dilemma, the climate change and nuclear energy dilemma, the pesticide use vs productivity and jobs dilemma, and so forth (Schiermeier, 2001).

Paradox

The Deep Ecology Movement has referred to the "living" paradox (Drengson and Inoue, 1995). From the Movement's perspective, governments must make a choice: should they leverage off death-giving technologies to save lives, or avoid technological misuse and live in ecological integrity? There also exists a public interest vs private gain paradox: people want a cleaner environment but do not want their lives to be disrupted and do not want to pay very much more to achieve it (Montgomery, 1996). In other words, do we take for granted that economic growth must adversely affect the environment? Yet another paradox related to the Ag-En interface is the challenge of "preserving access to the environment and its resources AND improving the standard of living" (Brower and Malcolm, 1991).

Diagnosis

This term is related to the others, but in a different way. It is increasingly being used in an environmental context: the Earth is sick and we need to diagnose the sickness by its symptoms and root causes, and then to identify possible cures - an analogy taken from the medical profession. For example, UNEP undertook an Aral Sea Basin Diagnostic Study in the early 1990s in order to obtain a clearer picture of the causes and effects of a desiccating inland sea (UNEP, 1992). The UNEP

study catalysed considerable interest and political action in the fate of the Aral Sea. There are calls for, and attempts to, identify appropriate indicators of objective environmental diagnosis. One corporation refers to the need for distance diagnostics through digital imaging. One can even apply for a Master of Science degree in Environmental Diagnosis at Imperial College in the UK (see: www.ic.ac.uk/default.asp?P=3608).

Thus, there are many ways to describe what goes on at the Ag-En interface. While attempting to stay focused on the notion of Ag-En hotspots, it is clear that any FAO-wide hotspots activity could provide a framework for a wide range of activities, with the Ag-En activity being central. Other hotspots assessments could include, for example, food insecurity, fisheries, livestock, nutrition or disease. Hotspots identification, monitoring and analyses would help to identify numerous environmental policy-making dilemmas, paradoxes and syndromes of interest to FAO, as well as to identify locations where diagnostic environmental studies need to be undertaken and tools are needed.

POTENTIAL INDICATORS TO IDENTIFY HOTSPOTS

In any hotspots monitoring arrangement, it is imperative to establish baseline conditions. As an example, one way to develop a hotspot baseline would be to use an approach taken to investigate the slow-onset, low-grade, incremental but cumulative degradation in the Aral Sea Basin in Central Asia (Glantz, 1999). In that assessment of several of the Basin's creeping environmental problems, a group of researchers from different disciplines and countries sought to identify thresholds over time of various environment-related changes (physical, biological and societal). The *suggested* thresholds of change that follow could provide a baseline and a timeline for tracking the development of Ag-En hotspots,

many of which hotspots are already active:

- Threshold 1: When was there an initial awareness of change?
- Threshold 2: When was there a realization that the change had become a problem?
- Threshold 3: When was concern expressed that the problem had become a crisis?
- Threshold 4: When was there an awareness of the need for action?
- Threshold 5: When was action taken?

It might be interesting to consider undertaking such a hotspots assessment for Lake Victoria in eastern Africa, using the creeping environmental problems approach, as various groups in FAO and elsewhere have already undertaken studies on various specific environmental changes in the Lake Victoria basin. The accompanying box provides an example.

FORESEEABILITY

The concept of "foreseeability" has been used for over a century as a legal test for liability. It is

"a concept used in various areas of the law to limit the liability of a party for the consequences of his/her acts to consequences that are within the scope of a foreseeable risk, i.e., risks whose consequences a person of ordinary prudence would reasonably expect might occur... In tort law... a party's actions may be deemed negligent only where the injurious consequences of those actions were 'foreseeable'" (Gifis, 1991).

There are several variations of the meaning of foreseeability. For example,

"the foreseeability element of proximate cause is established by proof that the actor or person of reasonable intelligence and prudence should reasonably have anticipated danger to others created by his or her negligent act" (Gifis, 1991).

Note that inaction is also considered to be a form of action. The negligence referred to is that of the authority who failed to have foreseen adverse impacts.

"Foreseeability encompasses not only that which the defendant foresaw, but that which the defendant ought to have foreseen" (Gifis, 1991).

The concept of foreseeability can be extremely useful for identifying the possible impacts of human activities related to agriculture on the environment in general, as well as on specific ecosystems of concern. "Foreseeability" differs from the concept of "forecast" or "predictability" because it neither depends on nor implies any quantitative description of probability of occurrence. It suggests, for example, that a reasonable person can conclude that certain agricultural practices in certain types of ecosystems, in the absence of any action to change them, will have knowable adverse impacts on environmental quality. Those adverse impacts can lead to such degrading processes as soil erosion, deforestation, fertilizer and pesticide overuse, excessive water diversions, poor irrigation practices, mechanization of land-clearing activities in marginal lands, and inappropriate land-clearing and wood gathering for cooking and heating (including charcoal-making for income) and construction.

Today, researchers have collected scores of examples of what happens when agricultural activities expand into new areas. In some instances, the land is transformed from one use to another. In other instances, however, that land use leads to varying degrees of degradation. What appears at first to be a harmless and productive change in the use of the land can (and often does) lead to a greater level of degradation that is harmful to both the environment and to the people whose livelihoods are based on the sustained productivity of that environment. People and governments need to be alerted as soon as possible to environmental changes that are often



Box 1. Lake Victoria as a hotspot?

Considerable attention has been focused on Lake Victoria in eastern Africa during the last few decades of the twentieth century. At first, scientific researchers focused their efforts on the variations in lake levels to determine global and continental climate history on millennial to century time scales. Today, research concerns centre on environmental degradation taking place in various ecosystems and in areas surrounding the lake. As an example, many changes have taken place since the Nile perch was introduced to the lake around 1960. What seemed to have been a good idea in terms of economic development for the region turned into a nightmare for local inhabitants dependent on basin resources.

Briefly, the Nile perch was introduced to create a fishing industry producing fish for export. Factories and large boats were then introduced to increase capture and processing activities. The Nile perch lived off the smaller fish species in the lake. Soon the number of smaller fish was greatly reduced, with a notable negative impact on the livelihood of small-scale fishers and fishmongers.

This led to worsening nutrition of local people around the lake. People bought the discarded Nile perch bones from the fish factories, because it was not easy for machines to remove the remaining ten percent of fish flesh from the carcass. Nile perch is an oily fish, unlike the local smaller fish, which could be sun-dried. The carcasses had to be boiled and, therefore, charcoal was needed for the fires. This led to an increase in the cutting down of trees and shrubs around the lake.

All the time the population around the lake increased, putting more pressure on the lake as well as on the surrounding land. Raw sewage and factory-produced effluents from the riparian states (Kenya, Tanzania and Uganda) as well as from other basin states (Rwanda and Burundi) flowed into the lake via rivers and streams. This nutrient loading of the aquatic ecosystem led to a sharp and uncontrolled increase in water hyacinth, which in turn adversely affected lake navigation and blocked sunlight from reaching the water's surface layer. This reduced the amount of oxygen in the water column, further reducing biological productivity of the lake's ecosystem.

Health conditions deteriorated markedly in the region for a variety of reasons, some of which are mentioned above. HIV too added to the deterioration of health conditions in the region of the lake. Many fishers and fishmongers became unemployed and had fewer resources with which to buy or barter food for their families. Poverty increased sharply in those once successful, even if only at a subsistence level.

Today, there are several studies focused on Lake Victoria and its basin: physical and biological, scientific, socio-economic, health and safety, equity and humanitarian, anthropological, sustainable development, sectoral (fisheries, forestry, agronomy, livestock), and so forth. There are many organizations that could work together to identify hotspots, even flashpoints, as well as Areas of Concern in the lake's basin. This regional case study could serve as a prototype for other regional hotspots audits and for identifying the many hotspots partners that could be brought together to address lake-related hotspots and flashpoints

Michael Glantz

incremental, but are cumulative and foreseeably damaging in the medium to long term. Taking agricultural practices into new areas, perhaps even into pristine ecosystems, launches one onto a proverbial "slippery slope" in the absence of precautionary policies and practices. The concept of foreseeability can help decision-makers evaluate long-term impacts of Ag-En decisions before those decisions are taken.

The notion of "present futures" is an important aspect of foreseeability. Identifying the rates and processes of land transformation in different ecosystems and identifying extreme hotspots (i.e. the hottest) that already exist can save considerable time, energy and resources, if that information is properly used to show responsible parties how a pursuit of their "business-as-usual" activities will ultimately affect the environment on which a country's citizens and economy depend. This could be viewed as "foreseeability analysis".

The use of recent analogous situations, i.e. "hindcasting", in a search for present futures can provide a reality check with regard to presenting realistic projections of societal and environmental changes within the region of the hotspots. They would be "case-based" and "place-based" scenarios; that is, scenarios that have already occurred somewhere else and in the relatively recent past. Reviewing past responses of decision-making authorities to the forecast and impacts of an adverse climate- or weather-related event can help to identify where, when and why good decisions as well as bad ones had been taken.

DEFINING "HOTSPOTS"

"Hotspots" has become a popular term in recent years. It is increasingly being used to draw attention to particular situations of interest or concern.

"Hotspots" is, in fact, a strange notion. Its specific meaning depends on the context in which it is used.

It brings to mind a location, activity or situation that is beyond the usual or out of the ordinary.

The term also has societal aspects: cultural hotspots, skiing hotspots, tourist hotspots, scuba hotspots, and so forth. Thus there are at least two general uses: one category uses hotspots in a positive sense, and the other in a negative way. For the general public, the term more than likely suggests a positive experience: hotspots for dancing, fishing, vacationing, and so forth. The negative sense suggests something unwanted or unfavourable that is likely to occur or is already in progress.

In the world of environmentalists, hotspots refer for the most part to negative changes. For FAO in particular, it refers to adverse aspects of the interface between agricultural activities and environmental processes, its primary concern. Some people might consider the recent surge in the use of the term "hotspots" to be a new environment-related fad. However it is viewed, the hotspots concept can be used to identify situations that, if left unattended, could prove harmful, both to the environment and to those dependent on it.

Recently, Conservation International (CI) published a map identifying biological and soil hotspots¹ (locations at risk to biodiversity loss). Interestingly, on the same map, the CI also introduced the notion of "bright spots," i.e. areas in which the degradation of soils had been either arrested or perhaps even reversed.

For our purposes, hotspots can be defined as locations or activities of interest to a group or organization where human interactions with the environment are considered to be adverse to the sustainability of an ecosystem or the human activities dependent upon it. It is a segment along a continuum of environmental change. This definition is purposely quite broad in order to allow for entry points into an FAO-wide hotspots programme for other activities related to agriculture, forest, fisheries, food security, and nutrition.

¹ <http://www.conservation.org/xp/CIWEB/strategies/hotspots/hotspots.xml>.



WHAT SHOULD BE THE FIRST STEPS IN A HOTSPOTS ACTIVITY?

The first concrete action to be taken in setting up a hotspots activity is to decide on an operational definition of hotspots, and then to define it more specifically in the context of the adverse interactions between agricultural activities and environmental processes.

It will be necessary to distinguish hotspots from flashpoints, critical zones (or areas of concern (AOCs)), and areas where land is transformed as a result of agriculture-related activities.

It is important to keep in mind the fact that not every interaction between agriculture and the environment is a negative, zero-sum interaction, where either the environment or agriculture wins and the other loses. For example, mixing agriculture and forested areas could be beneficial for both agriculture and the environment.

Mixing livestock rearing and cultivation has also proven to be beneficial to both activities, as well as to the environmental setting in which they are taking place.

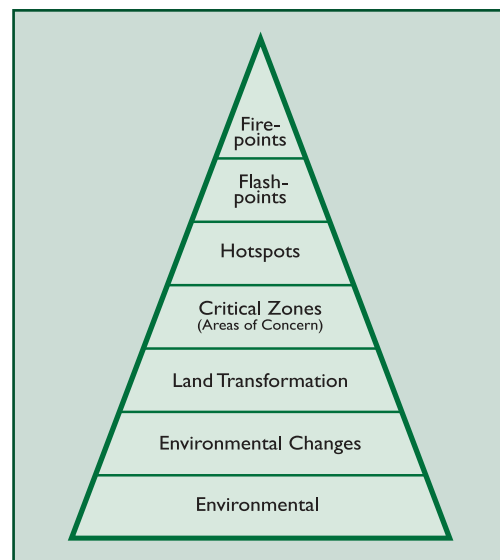
The overriding objective of a hotspots focus is to avoid creating them where they do not yet exist. A hotspot of environmental change (such as degradation) encompasses only a portion of a continuum of the full range of environmental changes.

While the hotspots portion of that continuum is the one that usually captures the attention of the media and policy-makers, in fact it is the portion of the process of change that precedes hotspots - the AOCs - that deserves more attention. Intervention in a potentially emerging hotspot can provide the most timely and least costly response to environmental problems.

A useful way to look at the notion of hotspots is to put it in a broader context. Schematically, it can be represented in the form of a pyramid.

The bottom five layers of this pyramid represent place-based conditions, that is, they are geographically defined areas. The upper two layers are time-based conditions, that is, they can occur anywhere and still have an influence on what happens to the place-based conditions. This graphically portrays one way to view the hierarchy of Ag-En interactions. It is important to note that there are human aspects to be considered at each level of the pyramid, such as why those interactions are taking place with adverse consequences.

The base of the pyramid represents the pristine environment. The next level focuses on land that is being or has been transformed, for example, from rangeland to irrigated or rainfed cultivation or transformed from a forested area to rangelands or cultivated areas, or from a mangrove forest into shrimp farms. Such changes are not necessarily degradation of the land's surface or of the vegetative cover, but are a change in land-use practices and a conversion in value from a societal perspective, depending on the spatial scale and the type of land conversion taking place.



The next level in the pyramid represents zones critical to human activities (AOCs). These are fragile zones, such as the tropical rainforests, semi-arid and arid lands, and inland water bodies or coastal waters. They are known to be highly susceptible to degradation in the face of inappropriate land-use activities or a variable or changing climate regime, or both.

Areas that have been transformed for agricultural purposes often become AOC critical zones and potentially hotspots. Critical zones can encompass entire countries, regions within them, or specific ecosystems. It could be an area "invaded" by people in search of lands to cultivate or by refugees from war or from degraded environments. Refugees tend to use the known farming practices that they had relied on in the areas from whence they came, techniques that were probably relatively more suitable for those soil or climatic conditions. Arid lands provide a good example of AOCs. While they can be sustainably exploited under certain known (i.e. tried and tested) land-use practices, the arid land surface (its vegetative cover and soils) becomes easily degraded in the absence of those practices. The irrigation of dry lands can be successful and sustainable in the long term, and in many places it has been. However, in the absence of proper drainage facilities, salinization and waterlogging of the soils can appear. Salinized soils must be repeatedly flushed of salts before planting can begin. If not flushed with clean water, the land may eventually have to be abandoned. Mangrove forests in general also represent an AOC.

The next level of the pyramid refers to hotspots. As noted earlier, these are locations where changes in

the way the land is used for agriculture-related activities impinge on the ecological health of the environment in which those activities are taking place (CENR, 2001). Hotspots are areas where the degradation of the land surface (reduced soil fertility, as manifested by declining crop yields) has begun to appear. The hotspot level of degradation can be subdivided into hot, hotter and hottest.

The next level of the pyramid represents the type of change referred to as "flashpoints". Flashpoints represent catalysts within the hotspots regions. They are time-based, whereas hotspots are place-based. Flashpoints can contribute to the instability in governments, economies, cultures or ecosystems.

A severe drought, for example, can become a climate-related flashpoint that generates or worsens political instability (e.g. the fall of the Selassie regime in Ethiopia in 1974, or the 1994 Rwandan crisis that coincided with unusually high food prices brought about by drought and an influx of refugees from Burundi).

Most often, meteorological drought by itself is not the *only* problem facing a country at a given time. Thus, the source of instability is a combination, often of drought with another adverse socio-economic or political change. For example, drought + high food prices can lead to famine; drought + political instability can lead to regime change; drought + poverty can lead to migration into marginal areas by the poor in search of farmland. This might be referred to as the "drought +" factor. Flashpoints convert severe land degradation problems into high-visibility political issues.

Options for Action

UNDERTAKE A HOTSPOTS AUDIT

AS A MAJOR CONTRIBUTION TO A HOTSPOTS INITIATIVE, SDRN COULD UNDERTAKE WHAT COULD BE CALLED AN FAO "HOTSPOTS AUDIT". The purposes of such an audit would be twofold. First, to identify hotspots identification and monitoring activities that are currently carried out by various groups within FAO. In fact, a first step toward such an audit was taken when SDRN convened its hotspots workshop in Rome in mid-December 2002. An audit would require a survey of FAO activities that relevant to the agreed definition of hotspots. Second a follow-up, involving undertaking a similar audit (assessment) within other organizations that focus at least some of their activities on hotspots-like detection and monitoring. These organizations

include, but are not limited to, the World Bank, the World Resources Institute, Lamont-Doherty Earth Observatory, Conservation International, International Strategy for Disaster Reduction, World Meteorological Organization, World Health Organization, and NASA. The results of these audits, as well as the definitional context of hotspots, would be placed on the Internet at a special Web site (with URLs like <www.FAOhotspots.org> or <www.hotspotsaudit.org>).



Ease of identification and monitoring of hotspots will probably vary, depending on the type of hotspot. For example, for **climate-related** hotspots, there is often an identifiable climate catalyst, such as drought, flood, fire, an El Niño or a La Niña event. For **Ag-En** hotspots, there are unlikely to be *obvious* thresholds of adverse impact, such as a rapid step-like change in environmental conditions (e.g. how many trees must be cut down before a change is referred to as deforestation?). Instead, one can expect a series of small, incremental (creeping), slow-onset cumulative changes. Nevertheless, for any one of the changes in the impacts at the Ag-En interface, there are sure to be underlying as well as precipitant causes that can be identified. It is most important to identify them early and, if possible, in the AOC stage, before they reach hotspot status.

Box 2. Nutritionists are very familiar with hotspots ...

Malnutrition frequently occurs in food insecure areas and reflects breakdown of local livelihoods or their inherent unsustainability.

Traditional farming systems - which are still prevalent in many remote areas - were usually fairly complex: they were based on local natural resources and were geared to provide basic needs, ensure community survival and minimize risk. Although clearly not perfect, they focused on local resilience since external assistance was not expected. With economic development, increased external involvement and new expectations, these systems have evolved. Abandonment of traditional farming practices and changes in rules and regulations have in some cases resulted in increased vulnerability to shocks (be they climatic or economic).

Poor people are clearly the first and the most affected. They may have had to migrate into forest or mountain areas under population pressure or civil unrest; tenure issues may be an obstacle to environmentally sound agricultural practices; conservation policies and projects limit access to forest resources (for fuelwood, fodder, timber or food); and survival strategies may lead to further environment degradation (e.g. charcoal production).

Coping strategies of food insecure (and therefore nutritionally at-risk) people often directly affect the environment: refugees exert an excessive toll on the wood resources; fields and traditional conservation practices are abandoned due to labour constraints (e.g. male migration in search of income, high incidence of disease - such as HIV/AIDS - or disability); cropping patterns undergo changes leading to overexploitation of soil resources. Typically, farmers are forced into growing more marginal land, i.e. land more difficult to work, stony, with low natural fertility or poor water storage capacity. Fallows also become shorter and shorter, thereby degrading the land and preventing the build-up of nutrients between cultivations. Marginal land will also tend to amplify environmental fluctuations (increase rainfall variability) instead of alleviating them, so that even a slight deficit of rainfall can trigger an agricultural or hydrologic drought and initiate the poverty spiral. Decrease in production is clearly reflected in decreased food consumption and limited food diversity, leading to stunting, micronutrient deficiencies and, eventually, wasting, which in turn affects the productive capacity of the household.

"Malnutrition hotspots" would include, for example, drought-prone areas of southern Africa and of the Horn of Africa, many mountain areas (Afghanistan, Nepal, etc.), forests in Central America, countries affected by conflict in the Great Lakes area of Central Africa, and many fast expanding cities.

It is therefore desirable that a hotspots audit approach involve specialists from both environment and social-related disciplines.

Florence Egal, FAO Nutrition Programmes Service, ESNP

A hotspots audit within FAO could be beneficial and serve several purposes at the same time, some of which include: early warning; crisis avoidance; minimizing "surprises;" and advise (or alert)

governments, international agencies and NGOs about the increased likelihood of severe environmental degradation that can result from human activities.



THE INTERFACE WITH RELATIVELY FRAGILE ENVIRONMENTS

The SDRN workshop deliberations in December 2002 in Rome could serve as a preliminary survey of the various activities and units in FAO already engaged in a form of early warning or hotspots-like identification. The groups represented at the workshop included those dealing with fisheries, food insecurity, nutrition, wetlands, forests, mangroves, rangelands, climate change and desertification.

Each organizational unit has its set of discrete functions to perform and objectives to achieve. Given the wide range of concerns, these objectives cannot be met by using only one universal set of indicators. For example, an early warning system for environmental degradation linked to agricultural practices will, to some extent, depend on the type of ecosystem affected and, depending on the ecosystem, will require different but overlapping sets of indicators. Thus, early warnings will vary for food security hotspots, Ag-En hotspots, rangelands hotspots, climate-related hotspots and nutrition hotspots. Thus, SDRN can develop a broad but usable definition of hotspot, and the other units can develop discrete operational definitions. All hotspots activities, however, could be listed on and linked to a "meta-hotspots" Web site, even though operating independently.

A second audit should be undertaken to identify the actual Ag-En hotspots around the globe in regions of primary concern to SDRN. Other FAO units interested in the hotspots concept could be encouraged to undertake a search for hotspots in their areas of interest. The results of all these audits would be placed on the meta-hotspots Web site.

Considerable research interest has focused on assessments of environmental processes of change, with less attention, relatively speaking, paid to the rates at which many of those changes are taking place. However, one could argue that the rates of

change are as important as the processes of change. Fast rates of change tend to stimulate if not accelerate decision-making processes in societal attempts to cope with the impacts of such changes. Slow rates of change, however, tend to be ignored as more urgent issues capture the attention of policy-makers. Ag-En audits would need to be undertaken periodically in order to monitor the rates of changes at the Ag-En interface, as well as monitoring processes (causes and effects) and trends.

The notion of Ag-En hotspots, broadly considered, requires thoughtful definition, even if aspects of the definition appear to be too qualitative to quantitatively-minded individuals. The *type(s)* of adverse Ag-En interfaces must be identified and prioritized in order to keep the activity manageable. It can become more inclusive as time progresses.

To undertake an Ag-En hotspots activity, it is important to maintain efforts for at least a three- to five-year period, during which the activity should be re-evaluated at a mid-course correction workshop (comparing objectives with achievements). There are several potential hotspots "auditors." For example, in-house FAO personnel, non-FAO personnel such as private consultants, or representatives of an environmental NGO could undertake an audit. It could also be undertaken by a combination of the above, or in cooperation with a yet-to-be-developed network of hotspots observers (e.g. volunteer hotspots monitors). Monitors could be identified in different regions defined as AOCs, as well as within areas already designated as hotspots. The expertise needed by the auditors would depend in part on the indicators and methods chosen for monitoring changes in the hotspots. Because those indicators are likely to be an effective mix of quantitative, qualitative and anecdotal, as well as physical, biological and social, auditor selection will be very important.

In fact, two sets of Ag-En auditors will be needed: the first set of auditors would be responsible for an

initial (first-time) audit, and would be guided by the indicators chosen by experts selected by SDRN.

Once those indicators have been chosen and the first audit carried out, a second set of auditors (or a consultant alone) would have the responsibility for subsequent audits, undertaken at a proposed two-year interval. The second set of auditors would be responsible for the presentation and publication of results of the audit and the projection of hotspot trends into the near future. These results would appear at first on the Internet, and eventually, as funding permits, as printed reports.

Information and data needs related to monitoring changes in hotspots, or perhaps AOCs, can be derived from existing data sources and time series of many types, *inter alia*: satellite imagery, NDVI, GIS, production statistics, environmental change indicators (soil erosion, soil moisture, extent and type of vegetative cover, deforestation rates, desertification data), food security and insecurity information, climate and climate-related time series, ENSO time series and forecasts, teleconnections projections for ENSO's warm and cold extremes (El Niño and La Niña, respectively) and historical accounts.

WHAT IS THE PRIMARY AUDIENCE FOR AN FAO AG-EN HOTSPOTS ACTIVITY?

There are many target audiences for the results and outputs of hotspots audits and activities (i.e. the identification, monitoring and reporting system). They include various groups within FAO and in other UN agencies, national policy-makers, researchers, specific government ministries, NGOs, and individuals and groups at the local and regional levels. Because it would be difficult to meet the specific needs and interests of each of such a wide range of potentially interested parties, it is important that those undertaking a hotspots activity identify and prioritize the primary audiences they wish to reach.

WHEN TO UNDERTAKE HOTSPOT AUDITS?

An Ag-En hotspots audit could be undertaken at two-year intervals. An audit would include documenting changes that had taken place in the previous biennium and, more importantly, projecting expected changes in the AOCs and hotspots at two-, five- and ten-year intervals. A two-year time interval (or greater) for a review of changes and adjustments to previous projections is considered adequate to capture the level of degradation at the Ag-En interface where hotspots are likely to appear or intensify but are not likely to have changed very rapidly from one year to the next, exceptions notwithstanding. In the two-year interval between successive audits, emergency bulletins in the form of watches, warnings or alerts could be issued if rapid changes were to occur, either for better or for worse. The projections would be based on changes in hotspot conditions under a "business-as-usual" scenario (i.e. based on changes in the physical, biological and societal hotspots indicators used for monitoring). This means that in the event of an absence of political or social responses to the continued degradation of the Ag-En hotspot, the hotspot could worsen to become a hotter or hottest hotspot: a location with severe degradation that sharply affects agricultural productivity and impinges almost irreversibly on the ecological health of the environmental setting.

WHAT PROBLEMS ARE ASSOCIATED WITH AG-EN INTERACTIONS?

With growing worldwide demand for food, fibre and cash crops, and with expanding populations in recent decades, an increasing number of locations around the globe have seen agricultural activities and environmental conditions (e.g. land, water, air, ecosystem and human health) interacting in adverse ways (e.g. the Ag-En interface: farm-forest, forest-plantation, food vs cash crops, farm-rangeland, etc.).



Depending on the eco-setting and the type of agricultural activity, these interactions can result in, for example, farmers encroaching on forested areas to cultivate new areas, or shrimp farmers carving out shrimp ponds in the mangroves to engage in short-term lucrative shrimp farming, or cultivators converting grazing areas into farms either for food or cash crop production.

In many instances, the movement of human activities has been into areas that are marginal for the those newly introduced agricultural or rangeland activities. When crop failures ensue, governments as well as farmers tend to blame drought, for example. This process has been referred to as "drought follows the plough" and has been described for processes in the United States of America, Africa, northeast Brazil and the Former Soviet Union (Glantz, 1994). Marginal areas can be defined by soil quality, rainfall characteristics, slope of the terrain, water availability and altitude).

To a certain extent, some land-use changes in various types of landscapes can be viewed simply as land transformation; that is, land transformed from one use perceived to be of value by one group, to a different use considered to be valuable by another group, without permanent harm to the environment: rangelands turned into cultivated areas, forested areas into sources of firewood, mangroves into a few small shrimp farms. However, if those transformations in a given locale continue, and certain (usually unanticipated) thresholds of adverse change in the environment are crossed, what was initially viewed as seemingly harmless land transformation has incrementally turned into severe land degradation. These locales can be viewed as Ag-En hotspots, where agricultural practices and environmental conditions interact to cause environmental degradation. If the processes of degradation are allowed to continue, the hotspot will become hotter and, if still left unattended, it could become a region's hottest hotspot. In addition, changes in the

productivity of the land are likely to occur as a result of reduced soil fertility or reduced yields.

The creation and evolution of Ag-En hotspots can be identified and observed on the ground, from aircraft, and from space - and even in libraries, with each data source providing unique, as well as overlapping, information. For example, local histories of land, vegetation and land-use changes, based on anecdotal, qualitative and quantitative data, can be used to track the history of land transformation in specific locations of concern, in order to identify when and where the path to hotspots emerged, as well as to provide leads about why they became problematic.

As another example, satellite imagery is used to detect changes in land cover over time, as has been clearly demonstrated in monitoring changes in the Brazilian rainforest in the Amazon basin, as well as with salinization of soils in arid areas, such as in Central Asia's Aral Sea Basin.

Anecdotal information, especially for early warning activities, can often prove to be as important as other types of information that are considered more scientific (e.g. quantitative) and, therefore, perceived to be more objective and reliable. However, stories about how the land and its vegetative cover have changed over time provide rich accounts of underlying, often hidden, factors and changes that might not have been captured by other methods of detection. Novelist Chaim Potok (2001) wrote that "without stories there is nothing. The past is erased without stories" (on the use of analogies and qualitative information for forecasting purposes, see also Glantz, 1991; Jamieson, 1988).

Perceptions of agriculture-related environmental changes do not always reflect reality. Nevertheless, people tend to act in response to their perceptions of reality, not necessarily on objective, quantifiable measures of reality. Their actions will have real consequences for agriculture and the environments affected by their perception-based actions.

A hotspots audit worldwide could help to avoid



crisis situations, and it could also serve to monitor existing creeping environmental problems. Creeping environmental problems (CEPs) usually prove to be an environmental change involving both human activities and natural processes, such as soil erosion, deforestation, forest die-back, desertification, mangrove destruction, coastal pollution, soil salinization or waterlogging. It is important to note that no government - rich or poor, industrial or agricultural, capitalist or communist - has as yet dealt effectively and efficiently with CEPs *until* those problems reached a crisis stage. Land degradation resulting from human activities is often a slow, low-grade, incremental but cumulative adverse change. In fact, most environmental changes in which human activities have been implicated have been of this creeping kind. If left unaddressed, such incremental, cumulative creeping changes often turn into CEPs (Glantz, 1994, 1999). Today's CEPs are likely to become tomorrow's environmental crises.

For some ecosystems, there may already be readily identifiable thresholds of change, when, for example, one type of vegetation is seen to invade an area previously occupied by another type. Unfortunately, for many ecosystems, those thresholds usually become visible only after they have been transgressed. This suggests that thresholds of environmental changes (transformation and degradation) need to be subjectively determined by concerned observers for purposes of monitoring as well as for pro-action (prevention or mitigation).

EARLY WARNING AND HOTSPOTS

Political interest in land transformation, degraded areas of concern, hotspots and flashpoints generally centres on a desire for early warning. Every government wants to know as early as possible about impending changes that can impinge, usually in a negative way, on the routine processes of government, normal politics and societal well-being. A

focus on hotspots is a focus on a transition zone where societal mitigative or preventive actions are needed, if continued degradation of the environment and the eventual degradation of the land's productive resources are to be avoided.

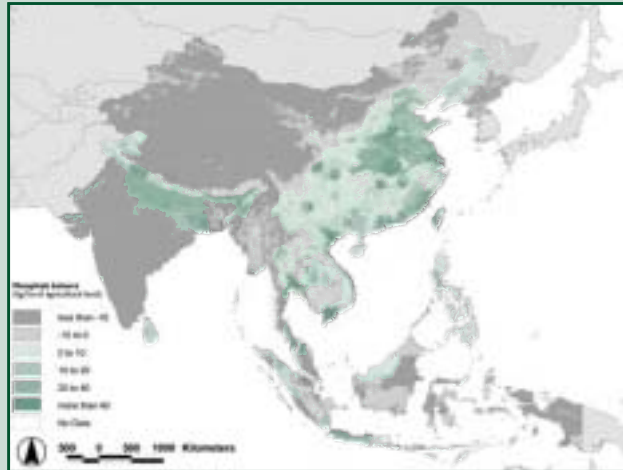
Government agencies, departments or ministries, each with their different bureaucratic jurisdictions, are interested in the earliest credible warning of potential problems they may have to face in their areas of responsibility. Thus, they are interested in identifying as far in advance as possible the factors that might add to cultural, environmental or governmental instability.

Nature-induced hotspots can, for example, be caused by naturally occurring volcanic eruptions or by El Niño events. Societally generated instability related to hotspots can be caused by ethnic conflicts, transboundary political differences over ownership of land or water, religious differences, and so forth. The causes for the emergence or continued degradation of climate and climate-related hotspots, for example, could be drought, flood, fire, frost, severe storms and the like. Ag-En hotspots, as noted earlier, occur when agricultural activities and the environmental setting in which they take place interact in a potentially adverse way.

Identifying the parameters of and value for the "earliest warning possible" of the likely emergence or worsening of an Ag-En hotspot falls under the purview of FAO. Hotspots, if left unattended, become hotter spots and can lead to any one or a combination of a range of impacts such as: a reduction in food production, a loss of soil productivity, food shortages, deforestation and environmental and societal problems related to desertification. Even if a government is not in a position to take action using its own limited resources to slow down or arrest the degradation of the Ag-En hotspot, it will have been at the least forewarned. This would allow the government enough lead-time to seek assistance from other countries.



Box 3. Nutrient overload hotspots in Asia



Overfertilization of crops, overfeeding of fish in ponds, improper management of agricultural and industrial wastes and other forms of mismanagement often result in nutrient overloads. Their major effects include surface water pollution with low oxygen contents and resulting mortality of aquatic organisms, threatening aquatic ecosystems and the quality of water for further uses, deterioration of the quality of groundwater, accumulation of nutrients and pollutants in the soil, and impact on natural areas such as wetlands, often leading to biodiversity losses.

The map above shows balances of phosphate on agricultural land, calculated on the basis of livestock densities, crop uptake, and chemical fertilizer use. If the balance is positive (red), there is an environmental risk due to oversupply of nutrients; large negative balances (green) point to a risk of nutrient depletion. Average values (light green to ochre) indicate that there is a potential equilibrium in the crop-livestock and crop-fertilizer-nutrient situation. Nutrient overloads are found in north-east India, east China, coastal areas of Viet Nam, Java (Indonesia), central and north Thailand, with especially high surpluses at the margins of urban centres, such as Bangkok, Ho Chi Minh City and Manila. It is estimated that about 25 percent of the agricultural land in the study area is subject to phosphorus oxide surpluses, while 15 percent suffers high surpluses (more than 20 kg P₂O₅/ha agricultural land). Livestock is the dominant source of nutrient around urban centres and in livestock-specialized areas (southern and north-eastern China), while chemical fertilizers are dominant in crop (rice) intensive areas.

Pierre Gerber, Pius Chilonda and Gianluca Franceschini (FAO Livestock Environment and Development Initiative) and Harald Menzi (Swiss college of Agriculture, Zollikofen)

HOW TO PROCEED?

The hotspots auditors should collect information and views about real and perceived hotspots from various individuals and from reports (published and unpublished), noting the definitions of hotspots and the indicators used to identify them. FAO could then select the set of indicators appropriate to its concerns in order to make its own selection of hotspots to be monitored and highlighted. Alternatively, it could collect from various organizations all of the identified hotspots, including those mentioned earlier, describe them and discuss the indicators that had been used to identify them.

The various factors involved in the creation and evolution of the hotspots of concern can then be analysed. The auditors would then project the likely progression of the hotspot over time. The likelihood (i.e. foreseeability) of a reversal or slowing down of the underlying processes that generate or maintain the hotspot can be assessed.

The auditors can use this information to search for, using analogues, "present-day futures" (e.g., present futures). Present futures refers to a belief that somewhere on the globe one can find a situation of degradation that closely resembles what the Ag-En hotspot of concern would most likely become, under a "land-use-as-usual" scenario.

As an operationalized notion, present futures underscores the belief that many processes of land degradation as a result of agricultural activities are neither new nor unique to a given ecological setting (see Box 4). Many of the Ag-En hotspots of concern today are likely to have already occurred somewhere on the globe. They have not only been experienced elsewhere, but many of those experiences have already been described in academic journals, popular magazines and in the "grey literature" (unpublished reports). This notion also reinforces the value of historical research for hotspots projections. By using historical examples of what could happen under a

"business-as-usual" scenario (i.e. no changes in human or climate behaviour or decision-making policy concerning the adverse interactions between agriculture practices and environment processes), potentially surprising outcomes of those interactions can be exposed to policy- and other decision-makers *before* they occur. Hence, some supposedly unknowable surprises can be revealed before they have a chance to occur ... and surprise policy-makers (Streets and Glantz, 2000).

BENEFITS

Undertaking Ag-En hotspots audits represents a unique niche for FAO. It would also help to identify FAO's "competitors" in a hotspots monitoring activity and would help to avoid duplication of effort. It would also help to identify partners for a collaborative hotspots monitoring and reporting effort.

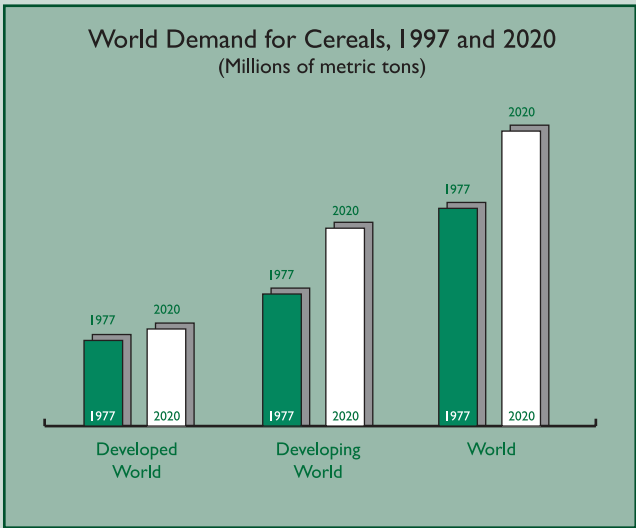
Some overlap among environmental hotspots-related activities could prove to be beneficial. The first global hotspots audit should be undertaken in the near future, and its initial findings placed on a user-friendly Web site. If the information derived from the global hotspots audit can be shown to be of value to governments and individuals, it could draw additional attention to hotspots themselves, as well as to the hotspots activity's contribution to environmental management from sources within FAO, and from other sources such as governments and research institutes.

If the audit is a cooperative effort among, for example, various groups in FAO and other organizations, such as the US National Center for Atmospheric Research (NCAR), or a UN agency, or a combination of UN agencies and private consultants, the task would be to the benefit of all partners. Such a cooperative Ag-En hotspots audit would probably generate a higher level of reliability in the hotspots products (i.e. outputs) and would increase the use and value of the hotspots Web site. SDRN would be



Box 4. Land Degradation

On about one-fourth of the world's agricultural land, soil degradation is widespread, and the pace of degradation has accelerated in the past 50 years. In developing nations, productivity has declined substantially on about 16 percent of agricultural land especially on cropland in Africa. The annual loss of agricultural land due to degradation is thought to range from 5 million to 12 million hectares, or about 0.3 to 1.0 percent of the world's arable land.



Estimates of the effect of degradation on agricultural productivity vary, but clearly the impact is significant in some regions. From 1945 to 1990, the cumulative crop productivity losses from land degradation have been estimated at about 5 percent worldwide, which is equivalent to a yield decline of 0.11 percent per year. In Africa, however, it is estimated that cumulative crop yield reductions due to past erosion have averaged about 8.2 percent for the entire continent and 6.2 percent for sub-Saharan Africa.

Source: Global Environment Facility, 2002: The Challenge of Sustainability. Washington, DC: GEF. 20 21.

in a position to become an authoritative voice on Ag-En hotspots.

Undertaking hotspots audits at two-year intervals provides a "breathing space" for the auditors. Within this time interval, they can review and re-evaluate the appropriateness of their indicators, monitoring and

methods. It allows for a review (also called a "hindcast") of previous forecasts, projections and responses that had been made in the preceding two years. The five-year interval for the projection of hotspots developments is a time frame of concern to political decision-makers, as it is often within their

period of political responsibility. These medium-term projections could be made on the basis of a "foreseeability analysis", as discussed earlier.

Decision-makers are not likely to feel a great deal of responsibility for future events that might occur well beyond their time in office. While a ten-year projection can be extrapolated under a "business-as-usual scenario," it runs the risk of being treated as too speculative.

COSTS

The financial costs associated with the first audit and with the development of the Web site will depend on several factors. The least expensive and perhaps fastest way to develop a hotspots activity would be for an FAO person to undertake, in a preliminary way, the initial audit within FAO. Alternatively, a combination of an FAO person or persons with an outside consultant could be invited to undertake the task. Also, a consultant could be retained to undertake the worldwide audit, which could be viewed as a prototype. By labelling the activity as a prototype, it would be considered for what it is: an experiment that, if meaningful, would be continued. The various audits could be undertaken in parallel rather than in series. A more comprehensive audit would also be of considerable value, but would require more resources, more time and possibly involve more people.

As a prototype, the audit could be carried out at least three times in a five-year period. This would provide the SDRN with time to review and assess the value of the hotspots assessment and its use by decision-makers. There is a risk, however, that if the activity is not labelled as a prototype *and* the audit is not a comprehensive one, it could be seen by others as an opportunistic, non-authoritative endeavour.

"Present futures" has been used in a different form elsewhere and has even been proposed by the IPCC as one approach that could be undertaken for impact scenarios for climate change [see IPCC Web site]. It

is referred to as "forecasting by analogy" (Glantz, 1988, 2001). Similarities as well as differences among Ag-En hotspots in different geographical locations need to be explicitly identified in order to minimize the possibility of relying on misleading or false analogies. Thus, analogies for present-day hotspots must be carefully and thoughtfully identified.

Those who identify hotspots could become involved in a "blame game" by, for example, having to identify governments, groups or policies that were responsible for or contributed to the adverse impacts of the interactions between agricultural activities and environmental processes. This is not an insignificant consideration, as potentially sensitive political issues are often involved. While government leaders like early warnings, they do not like to be identified in a bad light, that is, they do not want to appear as the party responsible for inaction. Hence, there is a need to identify how best to inform decision-makers and the public at the same time. This, however, could be a more balanced activity if in the hotspots of concern one also identifies "bright spots," locations where positive changes are or have taken place at the Ag-En interface.

EDUCATIONAL ASPECTS

There is a need for hotspots **education**. Creating an Ag-En hotspots audit and reporting the results on the Internet is an important step toward educating policy-makers at all levels of society, from local to global, and the general public about where, when, how and why such hotspots can and do develop. Some of the educational lessons drawn from an audit will be case- or time-specific, while other lessons will prove to be more generally applicable to Ag-En interactions. Creating awareness, if not taking immediate action, is a major as well as necessary step toward eventually addressing the underlying causes of Ag-En hotspots, and not just reacting to the apparent catalyst. Without awareness, there can be no hope for timely and





appropriate intervention to arrest and possibly reverse the change from hot toward the hottest of hotspots.

There is also a need for hotspots **re-education**. Because education is not a one-time activity, constant reinforcement will be needed of the original educational activities relating to Ag-En hotspots. This will require periodic updating with new information about positive and negative changes in hotspots, identification of emerging hotspots, adverse changes in AOCs, and the identification of potential flashpoints. Doing so will minimize a tendency of policy-makers and the public to "backslide," that is, to stop paying attention to what is happening around the globe with regard to the Ag-En interface. However important the Ag-En hotspots might be now or in the future, people making decisions at all levels of

society are confronted by many situations that require immediate attention. Thus, once begun, a hotspots activity should include continuing re-education (i.e. reminding readers of the "basics"), in addition to providing updates on new hotspots as well as bright spots.

A HOTSPOTS WEB SITE

For a hotspots Web site, FAO has the option to develop and maintain either a passive, an active, or an interactive Web site. A *passive* Web site would provide baseline information on Ag-En hotspots, which would be updated infrequently and presented on a "take it or leave it" basis. At the least, a passive Web site would provide FAO with a presence in the area of hotspots identification and monitoring. It

would demonstrate an institutional interest in the notion of hotspots.

An *active* site would require frequent and routine updating, as new information becomes available and additional links to new sources of information are identified. New material would be added, as the monitoring of the specific hotspots progresses beyond the baseline.

An *interactive* Web site does all that an active one does, but it allows for active, almost real-time participation by visitors to the Web site. It can do this by:

- ▀ posing questions to visitors interested in agriculture's impacts on the environment;
- ▀ encouraging feedback on controversial issues; and
- ▀ by engaging visitors in the search for or monitoring of areas of concern (AOCs) and hotspots.

There are many interesting aspects of an interactive Web site that could be developed to the benefit of FAO and the visitors to site, which could also include short guest editorials.

IDEA BANK FOR A HOTSPOTS WEB SITE

The SDRN should consider creating a "hotspots idea bank". Located on the hotspots Web site, suggestions about various aspects of hotspots would be raised for open discussion in an electronic forum, managed by those in charge of maintaining the Web site. People would be encouraged to provide information on worrisome land transformation, and on potential and actual hotspots that might have been overlooked in an annual hotspots assessment. An Idea Bank would also introduce to the general public the notions of present futures, forecasting by analogy, business-as-usual scenarios, CEPs related to agriculture, foreseeability analysis, and so forth. In this regard, the hotspots Web site would fulfil an educational function, making it interactive as well as active.

OVERALL BENEFITS

The notion of an audit is an effective one; everyone knows about audits. An Ag-En audit, however, would be user-friendly, and would necessarily be undertaken in cooperation with the group(s) being reviewed within FAO, other UN agencies, and the geographical regions being audited. Such an audit would be a benefit to all, i.e. a win-win situation. Governments would be alerted to emerging or worsening environmental problems involving agriculture. FAO, for its part, would be in a position to give support to those governments or decision-makers who are willing to address Ag-En hotspots.

An FAO hotspots activity can build (i.e. "piggyback") on the efforts of other hotspots-related activities already underway. By building on and working in cooperation with other activities related to hotspots, FAO can avoid duplication of effort. More importantly, FAO would not have to start from zero with respect to identifying Ag-En hotspots, nor would it have to rely on its own resources for such a potentially major ongoing task.

Putting the findings of the first and future hotspots audits on the Internet would give FAO and SDRN a definite presence in the area of Ag-En hotspots identification, monitoring, forecasting and, perhaps more importantly, "foreseeing". Hotspots audits would place SDRN/FAO in a leadership position on Ag-En hotspots, using an invisible hand (for example, this could be accomplished by assembling people who have the same Ag-En hotspots concerns). Aside from the FAO December 2002 workshop on hotspots, there has not yet been any formal meeting focused on Ag-En hotspots, although there have been publications on related topics.

- Borgstrom, G.** 1972. *The Hungry Planet: The Modern World at the Edge of Famine*. 2nd ed. New York, NY: Macmillan.
- Brower, L.P. & Malcolm, S.B.** 1991. Animal migrations: Endangered phenomena. *American Zoology*, **31**: 256-276.
- CENR** [Committee on Environment and Natural Resources]. 2001. *Ecological Forecasting: Agenda for the Future*. Reston, VA: NBII National Program Office (see: www.nbi.gov).
- Dohrs, F.E., Sommers, L.M., & Petterson, D.R.** 1955. *Outside Readings in Geography*. New York, NY: Thomas Y. Crowell Co.
- Drengson, A. & Inoue, Y.** (eds). 1995. *The Deep Ecology Movement: An Introductory Anthology*. Berkeley, CA: North Atlantic Books.
- Gifis, S.** 1991. *Law Dictionary*. 3rd ed. New York, NY: Barron's Educational Series Inc. See pp.195-196.
- Glantz, M.H.** 1991. The use of analogies in forecasting ecological and societal responses to global warming. *Environment*, **33**: 11-15, 27-33.
- Glantz, M.H.** (ed.). 2001. *Once Burned, Twice Shy? Lessons Learned from the 1997-98 El Niño*. Tokyo: United Nations University Press.
- Glantz, M.H.** (ed). 1999. *Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin*. Cambridge, UK: Cambridge University Press.
- Glantz, M.H.** (ed). 1994. *Drought Follows the Plow*. Cambridge, UK: Cambridge University Press.
- Glantz, M.H.** (ed). 1988. *Societal Responses to Regional Climatic Change: Forecasting by Analogy*. Boulder, CO: Westview Press.
- Jamieson, D.** 1988. Grappling for a glimpse of the future. pp. 73-93, in: M.H. Glantz (ed). *Societal Responses to Regional Climatic Change*. Boulder, CO: Westview Press.
- Montgomery, W.D.** 1996. Developing a framework for short- and long-run decisions on climate change policies. In: *An Economic Perspective on Climate Change Policies*. Washington, DC: American Council for Capital Formation Council for Policy Research (See: www.accf.org/296int.htm).
- Petschel-Held, G., Block, A., Cassel-Gintz, M., Kropp, J., Ludeke, M.K.B., Moldenhauer, O., Reusswig, F., & Schellnhuber, H.J.** 1999. Syndromes of global change: A qualitative modeling approach to assist global environmental management. *Environmental Modeling and Assessment*, **4**: 295-314.
- Potok, C.** 2001. *Old Men at Midnight*. New York, NY: Alfred A. Knopf.
- Schiermeier, Q.** 2001. Senate urges Bush to act on climate change. *Nature*, **412**: 575.
- Streets, D.G. & Glantz, M.H.** 2000. Exploring the concept of climate surprise. *Global Environmental Change*, **10**: 97-107.
- Tucker, C.J., Dregne, H.E. & Newcomb, W.W.** 1991. Expansion and contraction of the Sahara Desert from 1980 to 1990. *Science*, **253**: 299-301.
- UNEP** [United Nations Environment Programme]. 1992. *Diagnostic Study for the Development of an Action Plan for the Aral Sea*. Nairobi: UNEP.

December 2002 Brainstorming at FAO HQ

MEETING AGENDA

SESSION I: Introductory session

Monday, 9 December, 09.00-10.30

Chair:	Barbara Huddleston , Former Chief, Food Security and Agricultural Projects Analysis Service
09.00-09.10	Welcoming statement Dietrich Leihner , Director, Research, Extension and Training Division, oic, Environment and Natural Resources Service
09.10-09.25:	Objective and scope of the meeting. Practical arrangements. R. Gommès , Environment and Natural Resources Service
09.25-09.35:	Introduction of participants.
09.35-10.05:	OVERVIEW OF AGRO-ENVIRONMENTAL HOTSPOTS Michael H. Glantz , Environmental and Societal Impacts Group, National Center for Atmospheric Research, Boulder, CO, USA
10.05-10.30:	Discussion
10.30-11.00:	Coffee break

SESSION IIa: Presentations by participants

Monday, 9 December, 11.00-12.30

Chair:	Jelle Hielkema , Senior Officer, SDRN
11.00-11.20:	THE DIALOGUE ON WATER, FOOD AND THE ENVIRONMENT Jean-Marc Faurès , Water Resources, Development and Management Service, Agriculture Department
11.20-11.40:	FOREST-RELATED CONSERVATION AND SUSTAINABLE FARMING ISSUES IN SOME HOT SPOTS OF LOW FOREST COVER COUNTRIES Syaka Sadio and Patricia Negreros , Forest Conservation, Research and Education Service, Forest Department
11.40-12.10:	CALCULATION OF AGRICULTURAL NITROGEN QUANTITY FOR EU15; SPATIALIZATION OF THE RESULTS TO RIVER BASINS Jean-Michel Terres , EU Joint Research Centre, Ispra
12.10-14.00:	Lunch break

SESSION IIb: Presentations by participants

Monday, 9 December, 14.00-17.00

Chair:	Jean-Michel Terres , EU Joint Research Centre, Ispra
14.00-14.20	LAND DEGRADATION ASSESSMENT Freddy Nachtergaele , Land and Plant Nutrition Management Service,, Agriculture Department

List of Participants

Name	Affiliation
Luca Alinovi	FAO-ESAF
Uwe Barg	FAO-FIRI
Michele Bernardi	FAO-SDRN
Gerold Bödeker	FAO-ESDG (Agriculture towards 2015/30)
Florence Egal	FAO-ESNP
Nadia El-Hage Scialabba	FAO-SDRN
Jean-Marc Faurès	FAO-AGLW
Michael Glantz	National Center for Atmospheric Research, Boulder, Colorado
Ariella Glinni	FAO-TCEO
René Gommès	FAO-SDRN
Jelle Hielkema	FAO-SDRN
John Hopewell	Amsterdam University
Alexis Hoskins	WFP-Strategy and Policy Division,
Barbara Huddleston	FAO-Consultant
Henri Josserand	FAO-ESCG
Parviz Koohafkhan	FAO-AGLL
Dietrich Leihner	FAO-SDR/SDRN
Sheila Mwanundu	IFAD
Freddy Nachtergaele	FAO-AGLL
Thierry Nègre	Joint Research Centre of the EC
Patricia Negreros-Castillo	Iowa State University and FAO-FORC
Francisco Perez-Trejo	FAO-GILD
Jenny Riches	FAO-ESDG (FIVIMS)
Tim Robinson	FAO-AGAL (LEAD Initiative)
Jean-Michel Terres	Joint Research Centre of the EC
Dat Tran	FAO-AGPC
Jeff Tschirley	FAO-SDRN
Tom Wassenaar	FAO-AGAL (LEAD Initiative)
Ron Witt	UNEP (DEWA-Europe)

ENVIRONMENT AND NATURAL RESOURCES SERIES

1. Africover: specifications for geometry and cartography, 2000 (E)
2. Terrestrial Carbon Observations
The Ottawa assessment of requirements, status and next steps, 2002 (E)
3. Terrestrial Carbon Observations
The Rio de Janeiro recommendations for terrestrial and atmospheric measurements, 2002 (E)
4. Organic agriculture, environment and food security, 2002 (E)
5. Terrestrial Carbon Observations
The Frascati report on in situ carbon data and information, 2002 (E)
6. The clean development mechanism (CDM): implications for energy and sustainable agriculture and rural development projects, 2003 (E)
7. The application of spatial regression model to the analysis and mapping poverty, 2003 (E)

The FAO Environment and Natural Resources Series is available through the authorized FAO Sales Agents or directly from Sales and Marketing Group, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy.

ENVIRONMENT AND NATURAL RESOURCES WORKING PAPERS

1. Inventory and monitoring of shrimp farms in Sri Lanka by ERS SAR data, 1999 (E)
2. Solar photovoltaics for sustainable agriculture and rural development, 2000 (E)
3. Energía solar fotovoltaica para la agricultura y el desarrollo rural sostenibles, 2000 (S)
4. The energy and agriculture nexus, 2000 (E)
5. World wide agroclimatic database, FAOCLIM CD-ROM v. 2.01, 2001 (E)
6. Preparation of a land cover database of Bulgaria through remote sensing and GIS, 2001 (E)
7. GIS and spatial analysis for poverty and food

insecurity, 2002 (E)

8. Environmental monitoring and natural resources management for food security and sustainable development, CD-ROM, 2002 (E)
9. Local climate estimator, LocClim 1.0 CD-ROM, 2002 (E)
10. Toward a GIS-based analysis of mountain environments and populations, 2003 (E)
11. TERRASTAT: Global land resources GIS models and databases for poverty and food insecurity mapping, CD-ROM, 2003 (E)
12. FAO & climate change, CD-ROM, 2003 (E)
13. Groundwater search by remote sensing, a methodological approach, 2003 (E)
14. Geo-information for agriculture development. A selection of applications. ** (E)
15. Guidelines for establishing audits of agricultural-environmental hotspots, 2003 (E)
16. Integrated natural resources management to enhance food security. The case for community-based approaches in Ethiopia, 2003 (E)

The FAO Environment and Natural Resources Working Papers can be requested by sending an electronic request to SDRN-Chief@fao.org or to Chief, Environment and Natural Resources Service (SDRN), FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy.

Availability: October 2003

Ar Arabic	Multil Multilingual
C Chinese	* Out of print
E English	** In preparation
F French	
P Portuguese	
S Spanish	

This series replaces the following:

- Environment and Energy Series
- Remote Sensing Centre Series
- Agrometeorology Working Papers

A list of documents published in the above series and other

