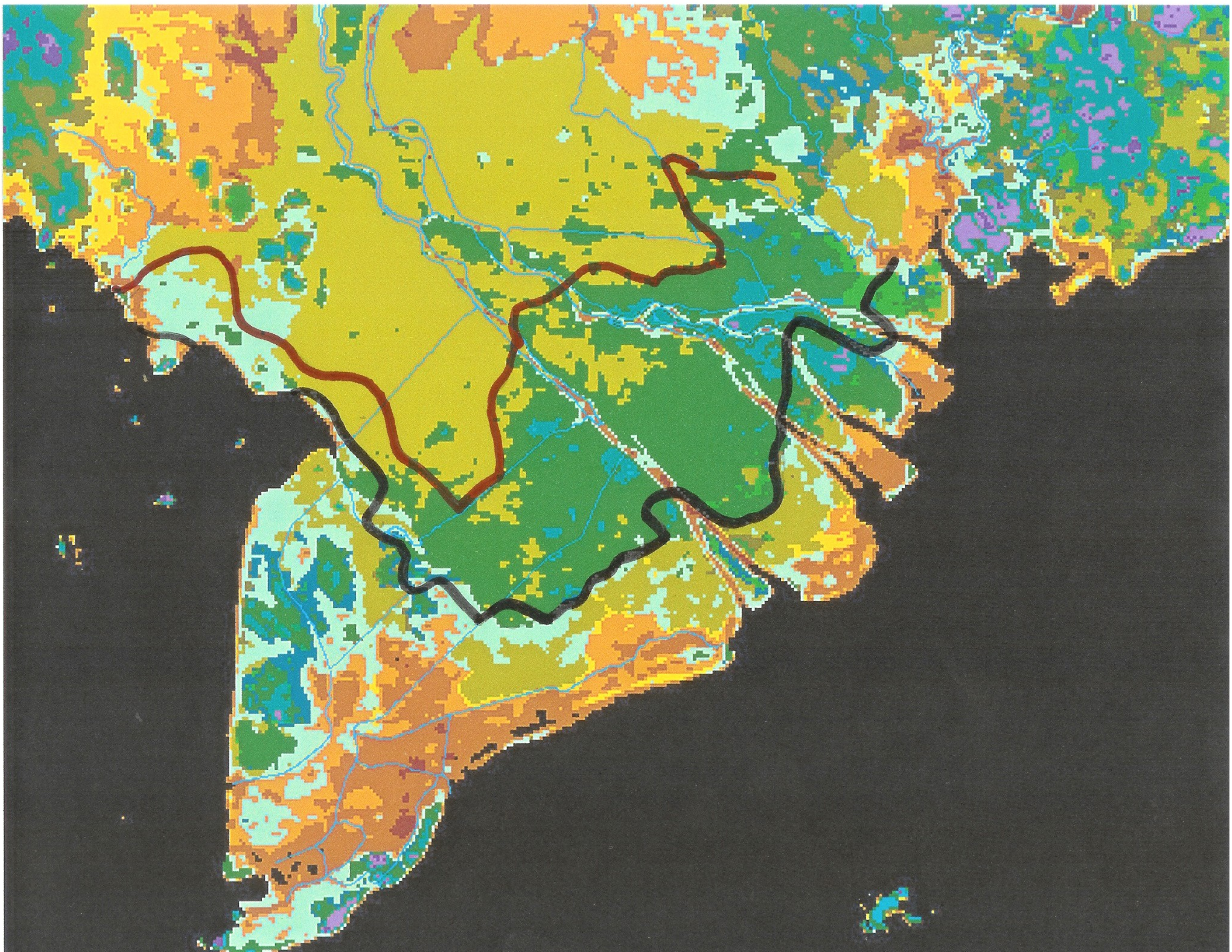
Paolo Santacroce and Silvio Griguolo

Identification of major poverty related hotspots in the SEA region, using hotspots most relevant global studies and synthetic environmental indicators



chapters 2 and 3
FAO/NRCB, SEA Poverty Hotspots (forthcoming)
DRAFT

Not to be quoted with the authorisation by FAO/NRCB

Chapter 2

The maps (and the related browsable database) included in the atlas represent a valid effort for a first status-of-the art of the overall SEA poverty-environmental data availability, at sub-national level.
As frequently emphasised, for assessing the progress toward the MDGoals, sound reference starting points should be identified. However this is not an easy matter: data availability is frequently scarce, data collection not systematic, and any attempt to use time series, when fortunately available, for comparison is frequently hampered both by different criteria adopted through years and sometimes changes of sub-national boundaries.

As in most developing countries - and between them in many SEA countries - the path, more or less successful, to reduce poverty is characterised by an increasing distance between sub-national units, the urgent need of sub-national assessments, based on the identification of their sub-national starting points, should be emphasised..
In other word, when measuring the achievements at national level the progresses could appear more positive (or less negative, it doesn't matter here) than when observing the same results using a sub-national magnifying glass.

	year	Headcount*	Gini coefficient
Cambodia	1997	21.60	0.370
	2004	19.00	0.417
Thailand	1996	6.00	0.434
	2003	1.60	0.645
Malaysia	1996	0.80	0.485
	2000	< 0.8	0.490
Vietnam	1998	16.40	0.354
	2002	13.60	0.375
Laos	1997	38.40	0.365
	2002	28.10	0.346
China*	1996	16.40	0.393
	2001	13.00	0.457
$1 a day (see source below)			

Already at national level, available trends of poverty headcount index (or poverty rate) and of Gini coefficient confirm this fact.
During the most recent years, SEA countries have shown a successful path in term of headcount index (when using WB estimation).
But on the contrary the Gini coefficients - a measurement for income inequality where 0 indicates perfect equality and 1.0 indicates perfect inequality, – are worsening toward 1.0.

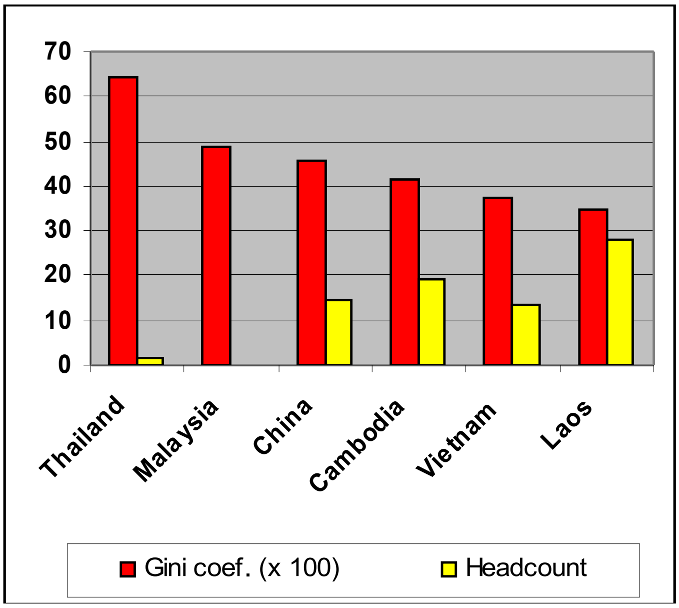
*overall China is included only for comparison: comparable Yunnan data are not available

Source: WB-East Asia and Pacific Region, East Asia Update, November 2005,
Countering Global Shocks, What Can East Asia Expect from the Doha Development Round? - Appendix , Table 8, Poverty in East Asia – Country Estimates.

The most relevant case is represented by Thailand, where a sound, positive path in term of headcount is paid by a drastic, dramatic increase of the income inequality.

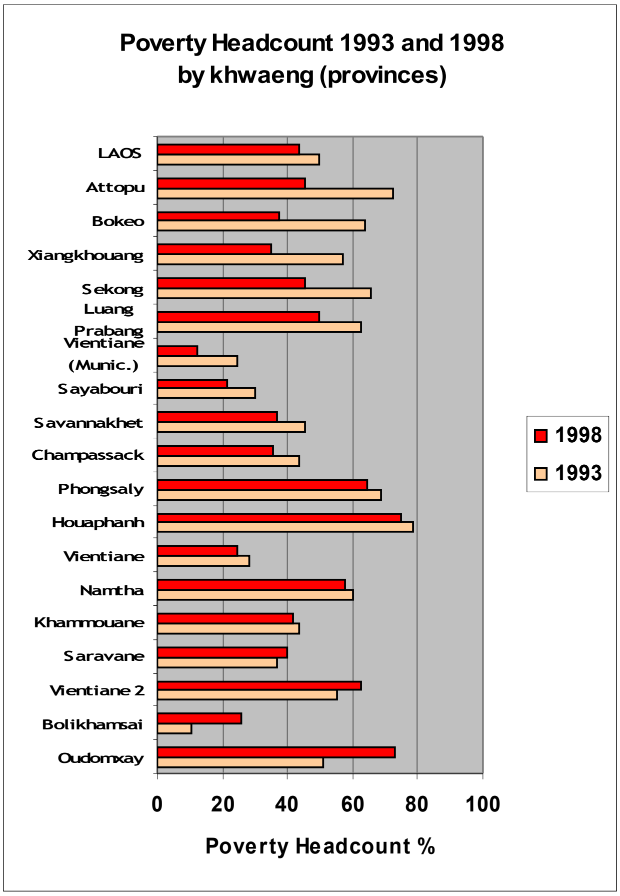
But in Malaysia too – where apparently the fight against the "less then 1$ x day" has been particularly successful – there is no mean to reducing the income inequality.
The table shows also China overall figures; the above dichotomic paths are strongly confirmed.

The chart here aside ranks the SEA (Yunnan excluded) countries in terms of Gini coefficient (red piles) for the most recent available year: the rules are evident: higher (worse) the Gini coefficient <-> lower the Poverty Headcount index.



This assumption provides an additional justification for a need of looking inside (and at sub national level) the mechanisms provoking these apparently contradictory trends.

The SEA Atlas, providing Poverty Headcount Indexes at subnational level, certainly will assist the users in understanding the poverty phenomena and what is it behind.



The Lao and Malaysia cases, for which Headcount Indexes are included for at least two years in the database, show how much a sub-national assessment could be important.

Let consider few, but important Laotian Khwaeng (provinces), mainly located in the central part of the country. During the '90, as shown in the chart here aside, their conditions worsened (no more recent data are available) while the overall Lao improved.

If we consider that these provinces are characterised by

- a high flood hazard (Dilley),
- slope constraints (IIASA),

and it is expected that

- the NPP per capita availability will drastically decrease during the next ten years,

in concomitance with

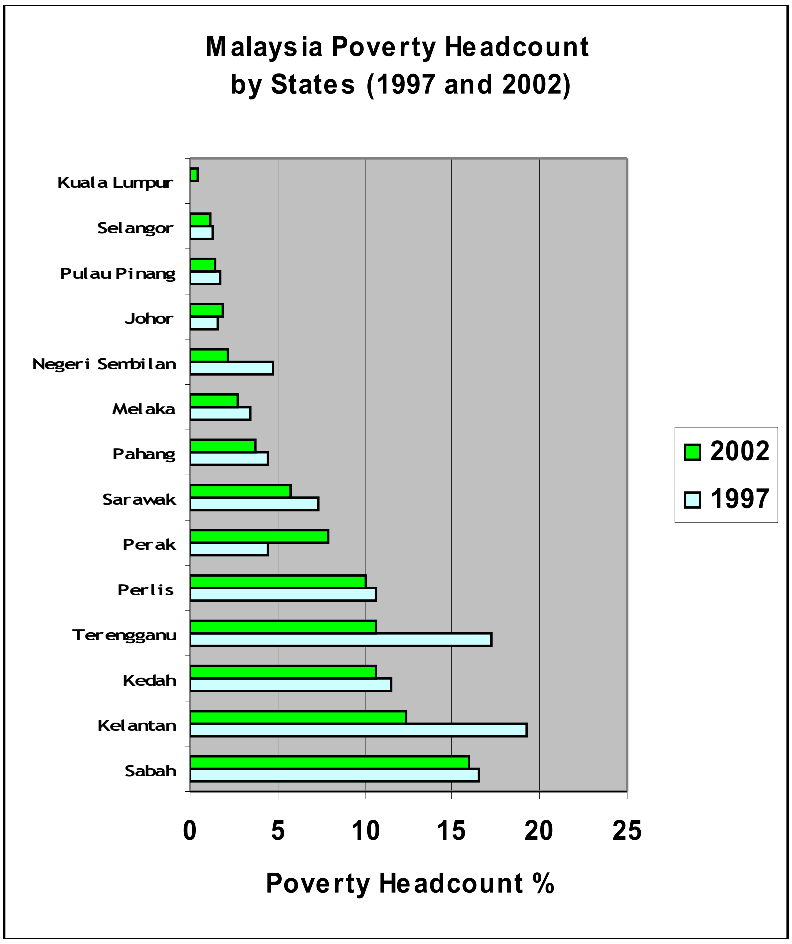
- a significant negative impact of climate change on multiple cropping production potential of rainfed cereals (IIASA/FAO GAEZ)

it is evident that the above provinces are already critical zones ("areas of concern") for a HSPs approach.

Additional, and probably more significant evidence, is provided by the Malaysian case, the SEA country more successful in fighting poverty.

While in 1997 Kellantan was the Malay poorest state, in 2002 it has been replaced by Sabah where the Poverty Headcount Index remained virtually unchanged during the above period.

There is strong evidence too - from the literature - that the so called hardcore poverty rate has not significantly changed.



The SEA database offers also the possibility of an overall comparative assessment, in terms of poverty headcount. A Poverty Concentration Coefficient (PCC) has been computed, and the outcomes are shown in the map in the next page[1].

Browner the areas are, more intensive (and, *ceteris paribus* affecting more people) when compared with the SEA' one the Poverty is; cyaner the areas are, less intensive the Poverty is.

The above Coefficient has the advantage of weighting the Poverty Headcount Indexes with to the related populations.

For decision-maker use, it could be a more suitable tool than a simple map showing the Poverty Headcount Index by districts.

The map shows, for instance, that in the border, remote areas between Thailand and Southern Lao, or between Eastern Cambodia and Vietnam, the demographic dimension of poverty is not as dramatic as it could be understood simply using a Poverty Headcount Map.
Probably a well targeted poverty alleviation policy could be easier there; cheaper and more successful than in other more densely populated areas, as requesting smaller resources.

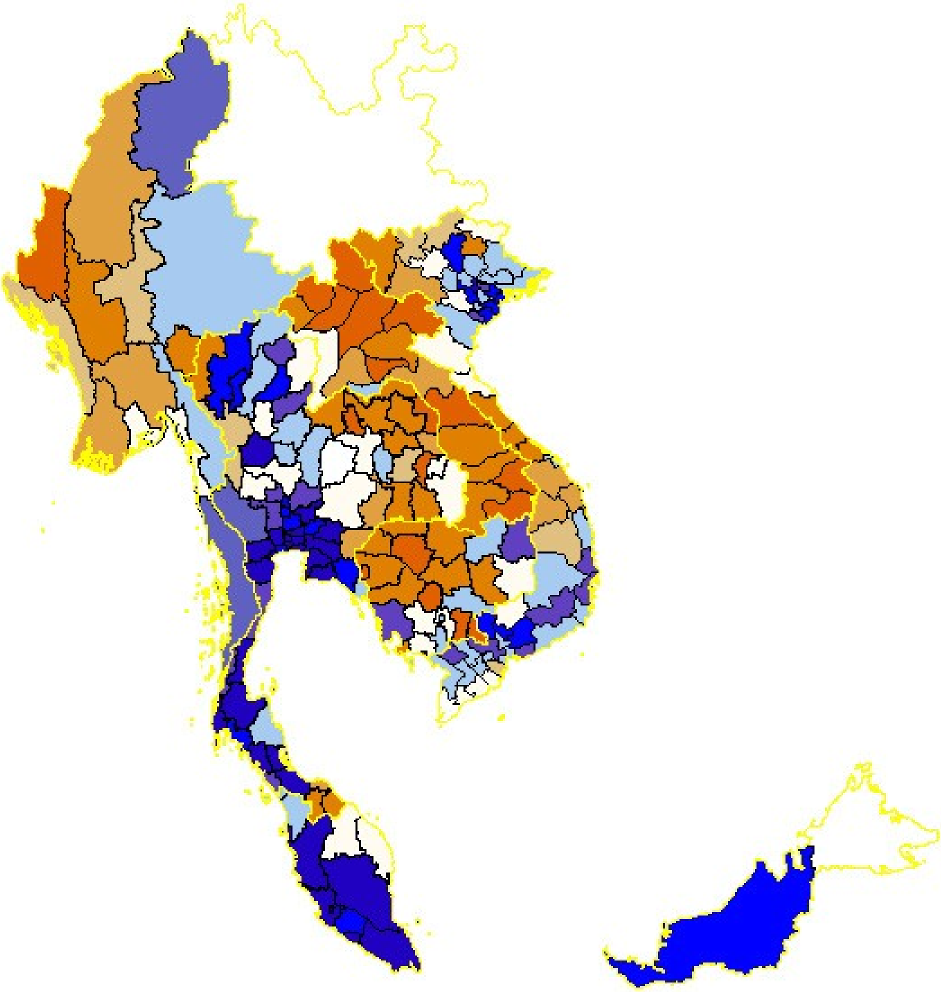
The above comment is important if we consider that the design and the structure of the SEA database has been conceived and build up as an attempt to assist the decision makers in their poverty alleviation policies, and these issues have justified the choose of indicators to be included in the database.

.

[1] The Poverty Concentration Coefficient is defined as the following ratio:

$$\frac{\text{Poor of a SEA specific district / overall SEA poor}}{\text{Population living in the same SEA district / overall SEA total Population}}$$

If the coefficient is > 1, it means that the poverty is more evident in that particular district.
The overall SEA Poverty Headcount Index has been estimated as = 16.35 according to the district most recent figures included in the SEA database.



However, when starting to collate information from several collected/accessible official sources, the above very challenging goals have found many tricky difficulties.

- First of all the lack of data for obtaining a homogenous, full coverage (SEA all countries) for most of the initially suggested indicators, should be mentioned. In many cases this fact, at least at the time being, is seriously hampering an overall area comparative analysis. This is particularly true for Yunnan, scarcely represented in the database, and for which a socio-economic separate analysis is carried out in this document.

- Time series of many important indicators included in the database current version are rarely and spottily available. These facts are seriously hampering a subsequent evaluation of their trends, and in particular are not of good help to assist in identifying some kind of "degradation process"[2], a fact so crucial for any HSP analysis.

- Difficulties for the users deriving from, sometimes, different national definition of the indicators, should be mentioned. Let think about the reference to national instead of to international standards used in some countries for anthropometric measurement. The user should be aware of this fact. Certainly their consequences, in case of an overall SEA comparative analysis, should not to be underestimated.

- And last but not least, while there is a general agreement that poverty is mainly (but not strictly necessarily) a rural issue, a scarce availability of agricultural and/or rural areas

[2] Martin Cassel-Gintz 2003

information should be emphasised. Let think about the farm-size and their polarisation processes induced by the "green revolution" in some country.

However - at least at the time being - to cope with this institutional data status characterised by such a big, unsatisfactory situation and by so many weaknesses, is necessary.

As the concept of "foreseebility" is at the base of any HSPs analysis, the most relevant issue is - at least - a sound (as far as possible) understanding of current socio-economic and environmental behaviours for identifying the possible impact of human activities on the environment.
How much difficult the above issue will be strongly depends from data availability.

Although both types and quality of available information seriously hamper a sound identification of most relevant HSps, as partially identified by literature and by "anecdotal information", however the SEA database allows in many case a computation of a suitable set of HSP proxies, with the advantage of providing their spatial distribution (at administrative level) instead of a rough, not geo-referenced information.
In other word: the SEA database represents a valid, although source-limited, contribution in this direction.

Probably most of the analysis could/will be carried out using separately sub-national set (it means: country by country analysis). An overall SEA area analysis for identifying the emergences of "areas of concern" and/or HSPs can be carried out only using few indicators and – in most cases – not the most suitable ones.

The outcomes of provisional attempts in these directions are provided in the following pages. The results, by no means, must be considered very consistent and satisfactory. Their main purpose has been - while providing a rough, provisional identification of a small set of "areas of concern" - to call for more significant indicators in order of getting a better HSP identification, both in terms of type of indicators and of geographic location.

In the following pages the reader will find the outcomes (described by maps and tables too) of two different analysis.
A first analysis makes reference to the whole SEA area, and is carried out mainly using physical/environmental indicators and few demo and agricultural observed/expected performances.
A second analysis takes into consideration a selection of the above indicators plus a small set of available socio-economic indicators. The analysis is carried out separately for six of the seven SEA countries (it means: Yunnan excluded) and for the Yunnan alone. This is due – as already emphasised – to a lack of comparable indicators.

If we agree with the assumption *that "the syndrome contexts describe the bio-physical, socio-cultural, economic, institutional and political milieu or environment, where specific set of patterns of civilisation-environment-interaction (HSPs), perceived as problematic due to their possible degrading effects on the social and/or economic and/or environmental side, take place"*[3], we must conclude that we are dramatically far away from a satisfactory result. The HSP multifaceted complexity is scarcely described by the few available indicators. The boxes included in the second part of this volume confirm this assumption.

[3] Martin Cassel-Gintz 2003, page 40

Surely there is an urgent need for better, more suitable, more reliable, more…, mpre… and so on indicators; but at the same time the boxes confirm that not necessarily the HSP expert family needs a systematic, statistic data set.
"Anecdotal information" - we wrote in 2003 – *"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"*[4]

Let be realistic: many of the indicators related to the cultural/institutional components of the HPSs, for instance the "commitment toward environmental policies" (see EPI analysis) or the "corruption index" (as used by the DRI approach) will never be available at sub-national level.
At least in the near future the HSPs approach should be similar to the Tyndal' one: once overall "areas of concern" and/or HSPs are identified at national level, a sub-national scale examination of types and levels of vulnerability of different population will be necessary.

Anyway, wherever we go, whichever approach we want to follow up, we can still agree with an urgent need for "awareness building" activities. Four years ago we insisted on "a need for hotspots ***education***"[5] *"Creating awareness"* had been considered fundamental *"for timely and appropriate intervention to arrest and possibly reverse the change from hot toward the hottest of hotspots"*[6]
Probably it is time for a first audit.

Before describing the provisional results of our attempts to identify "areas of concerns" and/or HSPs using indicators included in the current version of the SAE database, let us develop few additional general remarks and few "area of concerns" issues.
The aim is both to emphasise the conceptual limits of our outcomes, due to scarce and not strictly-related available information, and also to suggest what could be done for improving the SEA database and which type of information are recommended, if possible, to be included in a new version.

The Poverty literature confirms that Poverty is not strictly limited to rural areas, as well as the HSPs literature emphasises that a complete overlay between the concepts of HSPs and poverty doesn't exist too.

The Cambodian Income and Expenditure Survey (1999) has largely demonstrated that the urban poverty (when excluding Phnom Phen) is higher than the rural one. Nothing surprising in a country disrupted by a tragic migration during the Pol Pot regime and still affected by a certainly less tragic, but certainly still bulky, internal long-distance migration with all its social and economic implications. Migrants to towns are losing the links with their rural neighbours. The traditional village solidarity, representing a fundamental safety net, is completely lost.

[4] Glantz, 2003, page 15
[5] Glantz, 2003, page 20
[6] idem,page 21

The mega-urban areas of the SEA countries show - and frequently physically hide with physical protections (as walls along the urban highways) - the urban poverty.
For instance the huge shanty enclaves of Bangkok (see photo here aside) offer an important alarm bell; poverty there is higher than in many Thai remote rural areas; social disruptions (sex trafficking, HIV/Aids) reach worryingly level, as well as hygienic conditions (in terms of malaria, unsafe water and the so-called "communal" toilets. These shanty enclaves offer a good example of the "favela syndrome" described by Petschel-Held

During the mid-1980s, in the over 1000 officially designated slum areas of Bangkok, the child undernutrition remained at an estimated rate of 42 to 50 percent, while the national rate declined impressively from 51 to less then 19 percent, due largely to rural-focused primary health care and poverty alleviation programs[7] The situation, although if improved during the 1990s and the most recent years, has not – comparatively - changed.

As far as it concerns the HSPs-poverty relationship it should be noted that many of the so-called "Petschel-Held syndromes"[8] are not necessarily related to poverty.

The

disposition to the HSP of the "Overexploitation Syndrome"[9], is affecting also most of the richest areas of the globe[10].

[7] quoted from Child growth, IoN-Mahidol University (1994).
[8] see Gaia, 1/2004 pages 42-49
[9] Cassel-Gintz and Petschel-Held 2000, WBGU 2000
[10] for instance: Canada, the USA Atlantic coast, Sweden and Finland, as shown in Gaia, op.cit., figure2

In general this syndrome is related to profit-oriented extraction of renewable resources in presence of policy failures with regard to stopping or regulating the exploitation.
In the case of many SEA countries the disposition factor of the "Overexploitation Syndrome" (i.e. the "accessibility and usability of forest" in presence of soft control policies) is governed by political and/or military decision makers.
The huge, wild and "illegal" logging practiced in many near-border areas of Cambodia is mainly the cost paid for a social reintegrating of the Pol Pot ex-fighters.

Logs are cut and taken away under a complacent "political/military blindness"; nothing to do with poor people slashing the forest for need of planting crops and surviving.

On the contrary: the returnees, in those areas, say that it is still too dangerous to go around due to mined field[11] everywhere.

They prefer to raise livestock, smuggling them in the nearer countries. In case of mine accident they will lose animal heads and not their life.

In the photos: Mine advertisement plates in northern Cambodia (right side) and Western Myanmar (left side)

In other cases a link between the "Overexploitation Syndrome" and the Poverty is more evident, but not necessary according to the Petschel-Held sequence[12].

Let briefly make reference to the effect of a land reform, provoking an "overexploitation syndrome" due to marginalised people migration.

According to many sources the Lao land distribution has been "*largely at the administrative officers' discretion",* and the resulting in strong differences of land size, land productivity and access to water. "*In order to avoid unequal and unfavourable land distribution, some people migrated to other places where they resume[d] the shifting cultivation".* Practicing there shorter off-cultivation periods, they provoked soil impoverishments and erosions. These facts *"brought about a vicious circle of poverty as lower yields proved insufficient for subsistence……worsening rural poverty*" [13]

The so called "Asian Tigers Syndrome" too is a HSP due to not-related-to-poverty contribution. This syndrome, associated with a rapid export-oriented industrialisation, without regard for environmental standards, has mainly provoked severe urban pollution and health problems. As a paradox the Asian Tiger Syndrome has offered a lot of job opportunities, although in Dickensian conditions.

---

[11] Mined areas are still heavily limiting the access (re-access) to land by new by farmer (or returnees). This is not only the case of the northern Cambodia but also, for instance, of the western borders of Myanmar. It has been notate that *"the most heavily mined areas are not [yet] producing due to many civilian casualties now, because people have fled"*

However there is, apparently, a new emerging concerns derived by the fact that narcotics traffickers and loggers start to mine or remine large areas for economic reasons. This is the case of the "Timber concessions opened in the border areas of Karen State south of the Thai town of Mae Sot. These concessions are believed to be held by high military and political authorities in Thailand"

.(see Landmine Monitor interview with Signals Intelligence officer for the Karen National Liberation Army.8 January 2001).

[12] See for instance in the second part of this volume the box: "Myanmar Hotspots".

[13] quoted from *Poverty Profile Executive Summary: Lao PDR*. March 2003, Japan Bank for International Cooperation

On the contrary the "Green Revolution Syndrome" is probably the most related to poverty. The introduction of high-yielding varieties by governments, with the purpose of ensuring food self-sufficiency, have frequently provoked environmental degradation and growing socio-economic disparities. Significantly one of the most warring outcomes has been the impoverishment of the diet, with cereals as a persisting, or even increasing, relevant component.

A combination of "Green Revolution", "Asian Tiger" and "Favela" Syndromes

The Thai case study, more extensively described in three boxes[14] of the second part of this volume, is synthesised here below because offer an emblematic example of a combination of three syndromes: "Green Revolution", "Asian Tiger" and "Favela". At the mean time this case study, that is a result of key informants interviews and brainstorming sessions, supported by a secondary literature and data review, confirms the relevance of Glantz' assumptions on *"Anecdotal information"*.

During the eighties and the first half of the nineties the Thai economy experienced one of the highest GNP per capita growths in the world. This extraordinary performance was the result of a massive extraction of surplus from rural areas in order to accumulate resources for industrial development.

A preliminary "agriculture-oriented" development model was followed by an "industrial export oriented" one. The shift from the first to the second model was fostered by the changes provoked by the first one; namely the expansion of paddy and an impressive "new frontier expansion" of the agricultural practices in the Northern and in the North-eastern areas[15].

While the "commercial and/or export oriented" farmers increasingly became related to agribusiness and export companies, the small scale farmers had to face a dramatic dilemma: "to shift on to not shifting" away from their traditional crop composition systems and move toward a system than could compete in the world marked. The majority of them**,** trying to become more integrated into the market became toughly indebted with middlemen, cooperatives and agribusiness companies. In many cases they sold at least part of their fixed assets (frequently including their land), changing their cropping strategy into a more cash crops profile, and started to sell their work as "casual labour" (mainly through the mechanism of temporary or seasonal migration

Consequently the industrialisation process could be boosted by fresh, cheap and unskilled labour force supply coming from rural areas[16]. In particular the small scale farmers who couldn't become more integrated into the market – due to lack of means for buying agricultural inputs and without access to marketing channels - become one of the most marginal group in the Thai society and significantly increased the cheap labour force army prone to migrate.
In any case the **"**non-farm income" became a significant component of the rural livelihood; rural and urban economy became more integrated.

[14] see: "Green Revolution Syndrome in Thailand" , "Combining Asian Tiger with Favela Syndrome in Thailand", and the excerpt from Thailand FIVIMS Report.

[15] Land was cleared through deforestation, paddy rice in the valleys while maize, soybeans, cassava, tobacco and vegetables in the hills were planted. At the beginning the major actors were the forest workers and the farmers from the densely populated rice plains; then traders, middlemen and agribusiness companies followed.

[16] The new industries had been located mainly in the outskirts of Bangkok. The numbers of industrial workers doubled from 1984 to 1993, most of them in Bangkok Metropolitan Area. Rural-urban migration was extremely significant particularly during the end of the eighties and the beginning of the nineties. During this period 25% of the population moved, young labourers aged 20-24 years accounted for 40% of the total, characterised by a female predominance.

This strategy dramatically ended in the slump of 1997, the milestone occurred on July 2, when the Thai Baht was floated and devaluated. A great number of manufactures slowed down their production and several closed down since July 1997 due to banks' unwillingness to lend them money. In many economic sectors, workers were laid-off or affected by a reduction of their working hours; the increase of unemployment rate was drastic; the urban poor, still marginal in the towns and particularly in Bangkok metropolis, had been the most severely affected.

A reverse migration phenomena appeared; apparently more or less two million of temporary workers went back to rural areas, although this flow-back seems had been overestimated[17].

The return of jobless workers had a double economic effect:

- no longer regular remittance for the still rural families,
- additional mouths (consumers) in the household.

These negative effects became particularly heavy as remittances from wages earned elsewhere had been (before 1997) a common practice, a significant life support in rural areas and an important component of rural economies. In many cases a vital source of income for supporting daily expenses and family investments in agriculture.

To pay back loans[18] became very difficult, at the point that many families lost their larger assets such as house and agricultural land. In many cases creditors seized family belongings and productive assets as unemployed families could not keep out with debt repayments. The number of holders with mortgaged land significantly increased in the most disadvantaged areas

As during the economic boom phase many farming households have sold off at least part of their land, becoming smaller landholders, they couldn't satisfy food and livelihood needs for so many returning consumers[19]; borrowing food and daily consumable from shops and neighbours became a common practice. Overall declining conditions in many rural areas was confirmed by an increasing protein energy undernutrition among the under 5 children and the drop-out from the primary schools.
However the poor urban inhabitants, who where living in slums in and around Bangkok and without rural relatives to whom to return, had been certainly the most affected group.

In term of long term consequences, the return-migration component added, particularly in marginal areas, additional pressure on land, with evident environmental consequences as putting stress on the more fragile part of the country

[17] Key informants refer to about one million people.

[18] Agricultural policies focusing on cash crops promotion have frequently put farmers in deeper debt.

[19] In many cases a reduced HH food availability (more mouths to be fed) provoked new migration patterns. Apparently many jobless returnees from Bangkok or other centres did not stay in their village for very long, particularly when belonging to families with little land, lack of other productive assets and many families member to feed.

In other case the need of saving family fixed assets obliged the returnees to travel far again to look for a new farm-off activity. A socio-psychological component ("re-adaptation troubles") was strengthening their migration decision.

The ”Mekong time bomb”

Probably the most relevant HSP in SEA, already much identified by the literature, and confirmed by many analysis, is represented by the so called Few emerging “areas of concerns” are described in the pages here below[20].

The Mekong, crossing or bordering the totality of the SEA countries[21], has historically shaped and governed the local people livelihood.
As an extraordinary source of biodiversity and with its seasonally changing level, the Mekong has created an extraordinary number of agro-eco systems, of which the most relevant are the unique-in-the-world Tonle Sap-Great Lake system in Cambodia and the Delta Area System in Viet Nam.
More and more people became, are and – probably – will be dependent from these systems; when “dependent” means also from the **fragility** of these systems.
Increasing dependency from a fragile environmental and human environment is certainly an “underlying functional patter” for a HSPs.

The Yunnan part of the upper Mekong river has shaped the historical agricultural landscape, where most of the cultivated land were/are located in the small plains along the Mekong river and its tributaries and enriched by periodic inundations and silt depositions, so important for maintaining soil fertility;

The decision of building large-scale dams[22] is already drastically affecting and changing the traditional livelihood systems, and not simply for people affected by a particular dam.
The occupation of large extents of plains, means not simply a significant loss of agricultural production in reservoir areas, but also implies forced resettlements of local population.

The resettlement strategy has consisted on moving people either to higher levels (up to the slopes) or to other already settled areas.
On one hand the farming of slope lands has increases erosion, provoking quicker then expected silting process of the artificial lakes; not to consider that the productivity on this land, mainly composed by swallow soils, is expected to quickly decline.
On the other hand the moving of people to already densely farmed areas has signified more pressure both on land and on “host” farmers[23].
Let consider that cultivate land availability per capita in Yunnan is one the China smaller one[24].

---

[20] See also the box: “Mekong River Hotspot” in the second part of this volume

[21] The Mekong River (4350 km) start from the Tibetan Plateau and assumes different names in different countries: Lancang Jiang (Turbulent River) in China, Mae Nam Khong in Thailand, Myanmar and Laos, Tonle Thom (Great Water) in Cambodia and Cuu Long (Nine Dragon) in Viet Nam.

[22] See map in the next page, downloaded from: K.Makkonen, Mekong Cooperation – The Linkages between Poverty, Environment and Transboundary Water Management in Southwest China’s Yunnan province

[23] Information extracted from WCD Case Studies, “China Country Review Paper, Experience with Dams in Water And Energy Resource Development In The People’s Republic Of China- Phase 1: Desk Study”, Scoping Paper, Final Draft: 24 March 2000

[24] Yunnan, located on Yungui Plateau, is mostly covered by mountains: the hilly land occupy 93 percent of the area. Agriculture is limited to few upland plains, valleys, and terraced hillsides. In the west Yunnan livestock is raised on steep slopes while timber is cut, with environmental effects. Yunnan is one of China's most undeveloped provinces, with more poverty-stricken counties than any other province. Among the 592 national poor counties in China, 73 were in Yunnan (2003??). In 1994, about 7 million people lived below the official poverty line (less than an annual average income of 300 Yuan per capita). The situation is rather improved in the recent year (2.86 million in 2002). However the substantial results has been achieved at growing cost for the environment

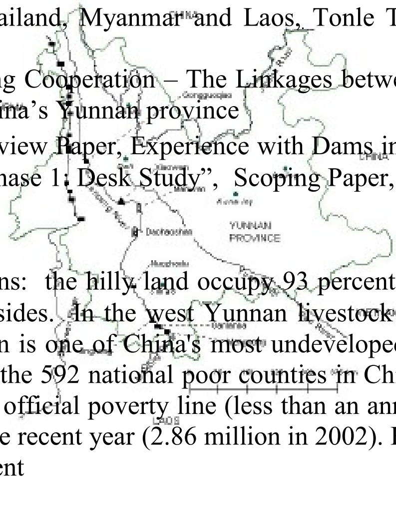


Figure 4: Upper Mekong (Lancang) and Salween (Nu) dams in the Yunnan province. The Lancang dams are marked by name and differentiated by whether the dam is completed, being build or planned (Source: Magee, forthcoming)

But there are also other implications for local livelihood. Fishing, both for commercial purpose and for subsistence has been an important activity (estimation says that the subsistence component was 9 time the commercial one).
The traditional local diet, although if quantitatively poor, was a clever combination of types of food with a significant fish component (so increasing its quality).
The dams system has already drastically reduced the fishing opportunities in dam downstream sections; both a less income and a diet impoverishment are the main consequences.

The dam system was claimed for contributing in assisting poverty alleviation policies in one of the China poorer region, on the contrary "*it appears that the upper Mekong dam cascade was proposed mainly in light of the national electricity shortage, rather than local power demands*"[25] It has been observed that :"*due to the fact that most of the electricity and profits appear to flow out of the production regions… it seems that the real benefit from the dam construction is going to the more developed parts of China".* [26]

An increasing impoverishment of the local population has been observed also for other dam projects in the SEA areas, with continuous conflicts between governments and affected villagers
This is the case, for instance, of the Pak Mun project that is probably the most controversial dam construction project in Thailand. In this case too, as in Yunnan, local people depends for their livelihood on fisheries in the upstream and downstream of the Mun River.
The lost swamps and wetland forests along the Mun River, once flooded during the rain season, were important places to let fish to spawn. The consequence now is a drastic reduction of fish catch. In addition local people got, for improving their subsistence, additional resources from bamboo shoots, mushrooms and other local plants growing along the river: easy to understand their impoverishment trend[27].

Along the Mekong, other "time bombs" can be identified in the Cambodian Tonle Sap area and in the Vietnamese Delta floodplains.

The Cambodian Tonle Sap Lake System represents another "area of concern".
The System, characterised by:
- a refilling during the so called "wet season" of the Tonle Sap Lake through the Tonle Sap River, starting late May up to September with a maximum inflow late August, and
- the reversal flow into the Tonle Sap River and the Viet Nam Mekong Delta ("dry season"), starting late September up to December (but with a quicker outflow in the few weeks between October and November),

remains one of the most productive ecosystems in the world, supporting directly or indirectly the livelihood of most of the Cambodian people.

This progress is also marked by a disruption of the social structure: it is officially recognised that children and women, living in the poor mountainous areas, are [still] rather vulnerable, and they usually become traffickers' targets. (see Li Mingchao, Speech at the Staff Meeting, ILO IPEC Mekong Sub-regional Project to Combat Trafficking in Children and Women , March 2000).

"Due to the reasons of poverty and increased mobility of population, the threat of HIV/AIDS and women trafficking are the emerging issues within the Lancang River Basin." (see: S Hopkins Leisher, *Situation Report on Lancang River Development in Yunnan Province, Chin,* Oxfam China

[25] He & Liu, 2002, quoted from Makkonen, op. cit.
[26] see again Makkonen, op. cit.
[27] information downloaded from: WCD Case Study, "Pak Mun Dam, Mekong River Basin,Thailand, Final Report": November 2000

More than one forth of the Cambodian population, leaving in six provinces, directly depends on the lake and its floodplains for their livelihood.
About 5% of Cambodia GDP comes from Tonle Sap fish catch.

In the photo: A lot of proteins wait for you at the Neak Luong Ferry on the Mekong (Cambodia)

The lake area increases, between the dry and the wet season, from 2,500 km^2 up to 15,000 km^2 in a typical flood season. The mean depth increases from the typical 1 m up to 6-9 m; and consequently the water volume increase from 1,5 km^3 up to 60-70 km^3.
In other terms the lake during the dry season is about 35 km wide and about 120 km long, during the wet season these dimension can respectively increase to 100 and 250 km.
Inundated forest and rice fields occupy the surrounding floodplains for an extent of 25-45 km. Fish and rice are the main outcomes of these extraordinary natural phenomena, offering an as much extraordinary balanced local diet.

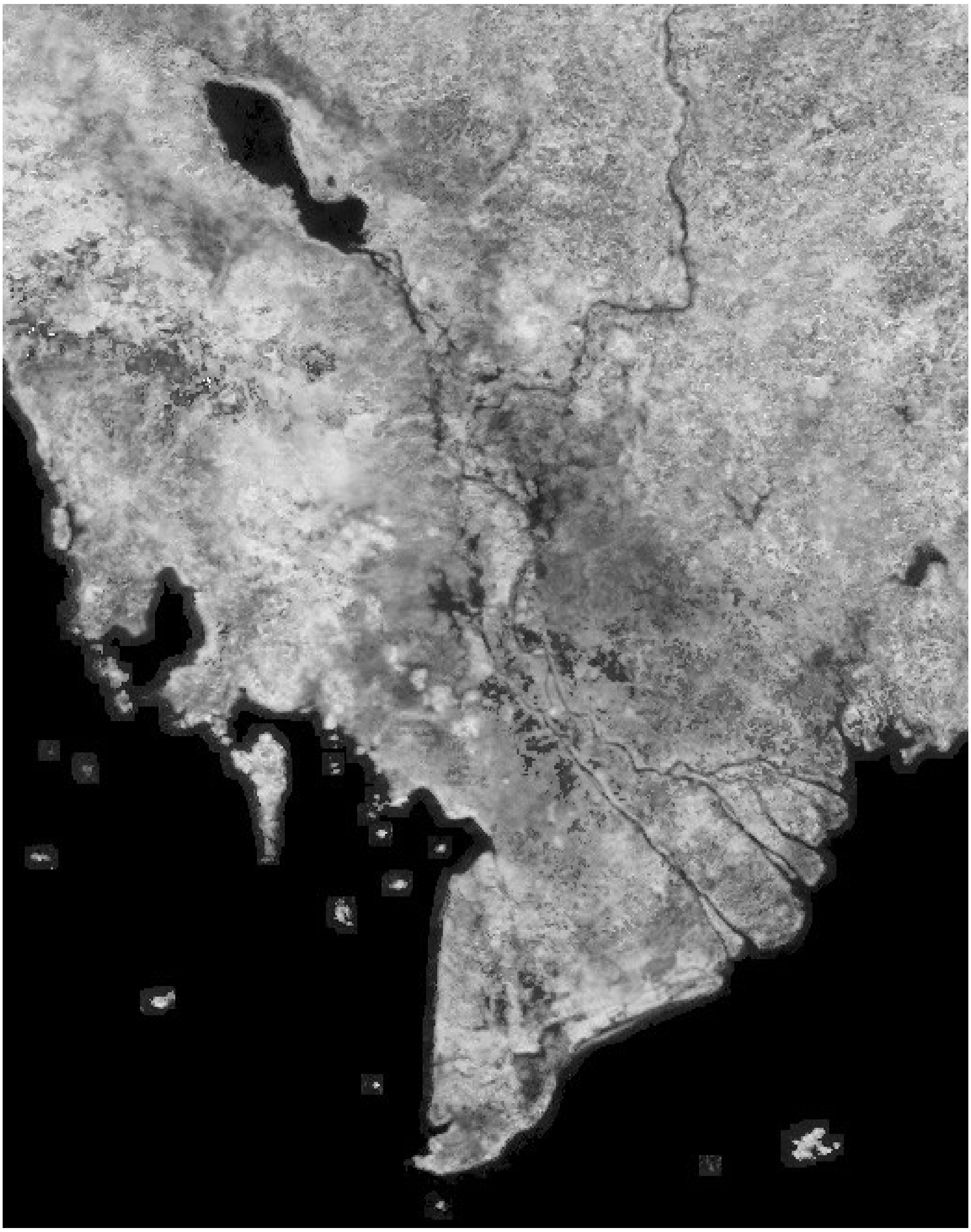
However this system is extremely vulnerable.
On one hand drought episodes (see for instance the year 1998) can recur due to a lower level of the upstream Mekong, provoking a reduced inflow through the Tonle Sap River. It is a fact that the lake natural catchment area provides only 40-50% of the flood; consequently any natural or man-made change in the upstream could have a dramatic impact on local population; in this optic any transnational water development project should be attentively evaluated at regional level.
On the other and the flood seasonal dimension and the dynamic of the spatial change increase the vulnerability of this area. The SEA "combined disaster hazard" classification, carried out through a data processing of the Dilley/WB grid images, and described in the next chapter confirms this concerns.

The lake system has an extraordinary role on regulating the floodwater in the lowest Mekong (delta). In august the Mekong average mean of discharge at Phnom Penh (upstream the confluence with the Tonle Sap River) is six times higher than the average mean discharge south of the above confluence: it means that more than 80% of the Mekong River waters are naturally diverted into the Tonle Sap Lake.
Consequently the Mekong delta (geographically starting south of Phnom Penh) is more protected by flood hazards during the wet season; and conversely benefits of providential water floods (outfilling of the Tonle Sap River) during the subsequent dry season (the so called "hydrological regulation").
In the Vietnamese Mekong Delta this hydrological regulation, assisted by very complicated system of hydrological infrastructures, has offered the possibility of managing three growing seasons (wet, wet/dry, d[28]ry) and consequently to achieve rice extraordinary performance (up to 5.5t/ha). The possibility of getting high/very high performances have provoked, as usual, a population greater concentration and a higher exposure to risk in case of specific natural disasters.
The strong dependency from the upstream Mekong floodwater and its interannual variability makes this area particularly prone to flood and drought. For instance the 2000 disastrous flood and the serious, although not so dramatic, 1998 drought represents the most recent evidence of this double-face vulnerability.

[28] see H Cross and R Beecham, *Modelled impacts of scoping development scenarios in the Lower Mekong Basin. Draft Report,*. Basin Development Planning Unit. Mekong RiverCommission Secretariat. March 2005.
See also figure 6.6 in: MRC, Overview of the Hydrology of the Mekong River, Vientiane, November 2005.

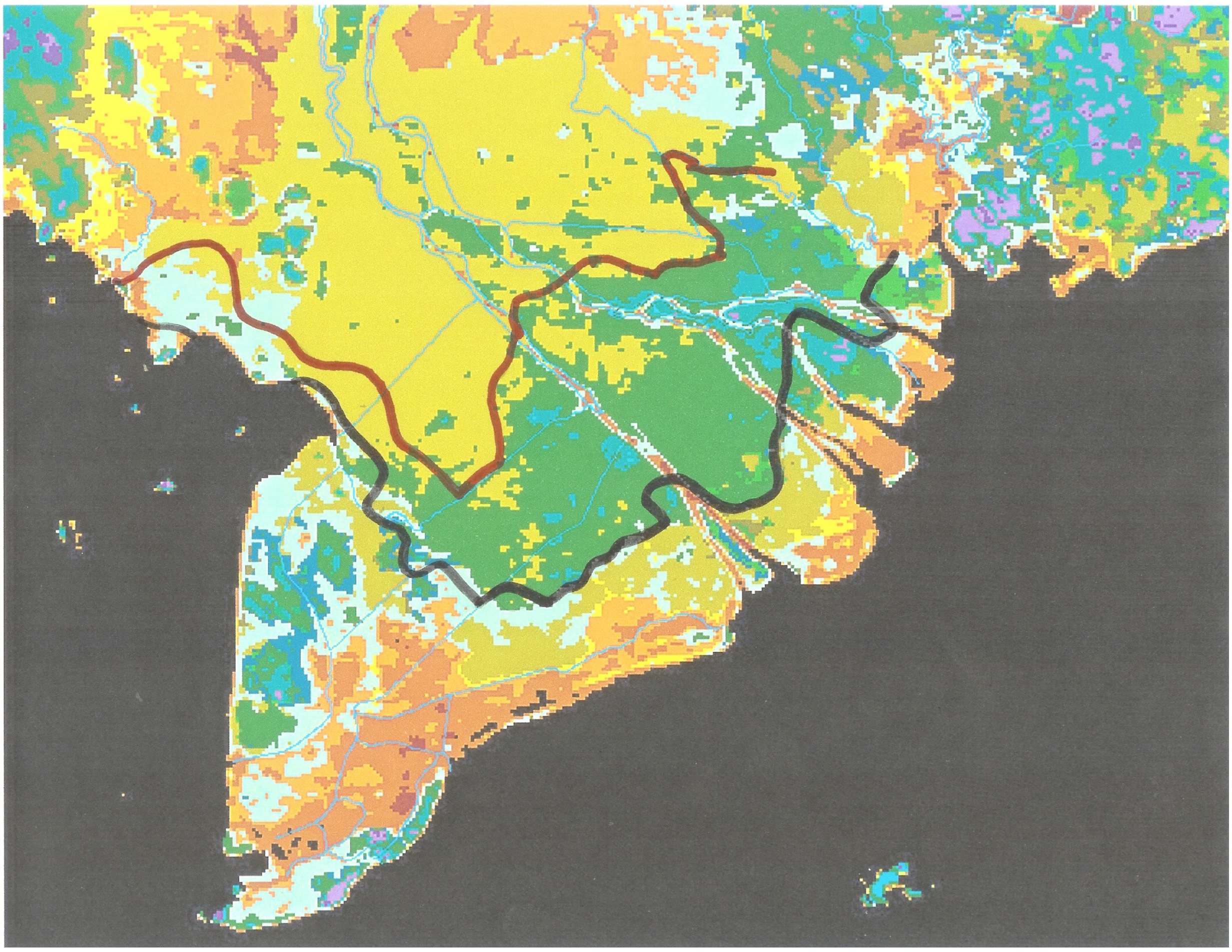
The Cambodian Floodplain and the Mekong Delta NDVI[29] images here below and in the next page offer an impressive visual assessment of these two opposite disasters. In the images the internal waters and the rivers are identified as the darkest areas. The same palette has been used when processing the two images.
The image here below makes reference to September 1998, 2nd decad (the driest in the recent years), while the second one (see next pages) shows the extents of 2000 big flood (October, decad 1st).

[29] VGT Spot images, 1km resolution



In general more emphasis has been given to the human costs of the 2000 flood (about 800 people died) than to the environmental costs of the 1998 drought, but these costs should not be underevaluated.
As most of the delta lower part is tidal, in 1998 the saltwater intrusion was extreme (apparently as much as 28,500 km^2 against the normal 15-20,000 km^2: nearly half of the delta total area.
This disaster affected for many years the rice performances; namely the rice is strongly negatively sensitive to saline water, and for this reason one of the three seasons (the dry one) couldn't be extensively carried out. Farming system strategy was adapted to the new equilibrium between fresh and saline water: an extensive rotating rice-shrimp system has been developed.

The approximate spatial borderlines of the "greater than 1 gram x litre" salt concentration in the water that occurred in 1998[30] according to their duration are shown in the map here below.
The black line borders the areas affected by the above salt concentration for more of five months, while the red one identifies the one week border. The map is a detail of the NDVI cycles classified image described in other part of this volume; interesting is the frequent matching between borderlines and vegetation cycles classes.



[30] Information from see H Cross and R Beecham, op. cit.

Other "areas of concerns"

Few but relevant other "area of concerns" should be shortly described.

Sex trafficking/migration/HIV-AIDS
Boxes in the second part of this volume indicate a growing relevance of HIV/AIDS related diseases.
Transborder sex trafficking/migration are one of the main vehicles of this increasing "area of concerns".
For instance in 1994 the quantity of women and girl trafficked from Myanmar to Thailand and working in the Thai brothels was estimated between 20,000 and 30,000 (Asia Watch, 1994), and worryingly increasing by 10,000 new recruits per year.
According to Unicef (1995) *"In some communities in eastern Shan State, around 20 percent of girls between the ages of 15 and 25 can be found in Thai brothels at any given time".* According to the same source 90% of the teenage rescued from a brothel in Chiang Mai in 1991 and returned to their homes in Shan State were found to be HIV positive.
Worth to be noted that Myanmar is also a transit county used by traffickers for moving women and girls from Yunnan to Thailand[31].

Logging
The forests, in many areas of SEA countries, are under serious treats. The deforestation is a combined result of - first of all - an increasing local demand for timber and fuel-wood (see maps in the SEA atlas) worsened by a demand coming from outside countries, to which land clearing for agriculture use and human settlement should be added.

Land clearing is frequently practised within systems of swidden agriculture characterised by shortened rotations when compared with the traditionally practiced ones. The result is a decreasing soil fertility and in general a land degradation, provoking a further claim on new lands to be cleared; closing an environmental perverse circle.
The long term environmental outcomes consist in a serious loss of biodiversity, for instance deciduous trees or bamboo forests are increasingly replacing the previous evergreen forests.

[31] quoted from Leena M Kirjavainen, Gender Issues Myanmar

Cambodia figures are extremely significant.
In this country between 1973 and 1997 about 100,000 ha per year have been lost (forests declining from about 13M to 10.5M hectares[32]. The deforestation annual rate has been estimated between 1 and 2%.
Pressures for wood expressed by outside countries should certainly be emphasised, but at the meantime it should not be underestimated that approximately 90–95% of Cambodia's population relies on fuel-wood as a major energy source[33]; the yearly arrival in Phnom Penh volume of fuel-wood has been estimate by FAO to be about 24thousand Mt.

There is an additional concern: for surviving in Cambodian remote areas most population relies on the forest not simply for timber, but for a large set of non-timber products and in particular for wild foods during the leaning periods.

The forests provide important sources of animal proteins from wild animals, and fodder for domestic animals too, and finally rural household still get the source of their traditional medicines from forest plants.

In the photo: a lot of Kcal from wildfood near Tbeng Meanchey (Cambodia)

[32] DFW estimation
[33] Phat et al., 1998

Looking for “areas of concern” is SEA areas

As already explained, provisional attempts to identify “predisposition factors” and, if existing, “area of concerns have been carried out.
Due to lack of compatibility between socio-economic indicators for the whole SEA area, it has been possible to carry out an overall SEA analysis only using physical/environmental indicators and few demo and agricultural observed/expected performances
A second type of analysis, that takes into consideration a selection of the above indicators interfacing them with a small set of available socio-economic indicators has been carried out separately for six of the seven SEA countries (it means: Yunnan excluded) and for the Yunnan alone.

The outcomes of these analyses are shortly provided in the following pages.

Environmental patterns and demographic trends.

In order to produce a first, whole SEA classification, four basic set of raster images have been processed for extraction of statistics at district level.

- Minimum NPP images, recently produced by FAO/XXXX (for year 2005 and 2015)[34]
- VGT /SPOT images (full available time series from April 1998 up to November 2005)[35]
- IIASA/FAO GAEZ plates[36]
- Dilley & other/WB Hazard Exposure digital maps[37]

Population had been extracted from CPW version 3 /CIESIN images. The CIESIN 2000 figures have been compared, at district level, with available information provided by National Statistic Offices. In some case serious gaps have been detected.

In particular some 2015 population projections seem rather inconsistent and, for at least three countries, apparently overestimated when compared with the official UN projection (when using the medium variant), see table next page.

	CIESIN GRID		(1)	% of districts with same		UN medium variant		(2)	(1-2)/2 %
	POP2005	POP2015	growth rate	population growth rate		POP2005	POP2015	growth rate	
CAMBODIA	14793861	18629962	2.33	54%		14071000	17066000	1.95	19.7
LAOS	5926447	7492270	2.37	33% and 39%		5924000	7306000	2.12	11.9
MALAYSIA	22123414	26204391	1.71	....		25347000	29558000	1.55	10.2
MYANMAR	48383037	53551391	1.02	....		50519000	54970000	0.85	20.3
THAILAND	65181214	71846946	0.98	....		64233000	69064000	0.73	34.4
VIET_NAM	80143582	92559378	1.45	59%		84238000	95029000	1.21	19.6

[34] for a short description of this source, and the used data processing see…
[35] for a short description of this source, and the used data processing see…
[36] for a short description of this source, and the used data processing see…
[37] for a short description of this source, and the used data processing see…

However the most serious problem sorting out when trying to use the CIESIN digital maps, consists in the fact that for some countries the national population growth rates has been applied to most of their pixels. This fact becomes evident when statistics at district level are computed (see particularly: Viet Nam, Cambodia and Lao).
The consequences of this over-approximation are evidently “fatal” for any attempt of further “fine tuning” analysis, particularly when looking for future balance between resources and population.
Very empirical solutions[38] have been adopted for interfacing demo and environmental data in order to carry out the multifactorial analysis described in the following paragraphs and synthesised in the map

Population density has been computed for the year 2000 using National Statistic Offices information.

Finally for a rough identification of area of (cereal) surplus or deficit the sum of rice and maize productions has been used as a proxy and used for dividing the estimated population.

Due to an evident lack of homogeneity between Dilley/WB data and the other ones, Dilley indicators have been used only as supplementary variables, for not interfering in the computation of the typologies.

The **most important result**, in an attempt to identify “predisposition factors”, consists in dichotomised tendencies between Yunnan and the other SEA countries in terms of near future per capita NPP availability.
It is expected that in the next ten years the expected per capita minimum NPP (Net Primary Production) will yearly decrease of about 1%, but this overall trend is the results of opposite tendencies: Yunnan will yearly increase for 0.20%, while the remaining SEA area will decrease of 1.15%
A positive impact of climate change on Yunnan had been already detected by the IASA/FAO GAEZ analysis (about 5%[39]); an opposite, seriously negative impact (about -6.5%) is expected for the other SEA areas, including local positive trends in some parts of Malaysia[40].
A data processing of the new minimum NPP images computed by FAO and included in the SEA Atlas shows how fragile, in the near future, the relationship between NPP and the population will be.

Looking inside this trend it’s evident that these results are the combination of two tendencies: while in Yunnan the average NPP will yearly increase 0.49%, this is not the case of the other SEA countries (only 0.03%).

---

[38] Population yearly compounded growth rates for the period 2005-2015 (since now: “the next ten years”) have been computed from CIESIN images when:

1) not far too away from the UN estimation and
2) when – at the mean time - showing different rates for different district of the same country.

For the countries for which these conditions were not satisfied extrapolations have been made using available recent population trends at district level. In this case the results, when matched at national level with the official UN population projections result acceptable.

When computing “per capita variation” of some figure during the next ten years, the above adjusted population growth rates have been used.

[39] The IIASA/FAO GAEZ figures are derived from Max-Planck Institute of Meteorology/ECHAM40 2080 and apparently cover the period 2000-2080. The information have been extracted from the digital plate n.68 (“Impacts of climate change on multiple cropping production potential of rain-fed cereals (high level of inputs”).

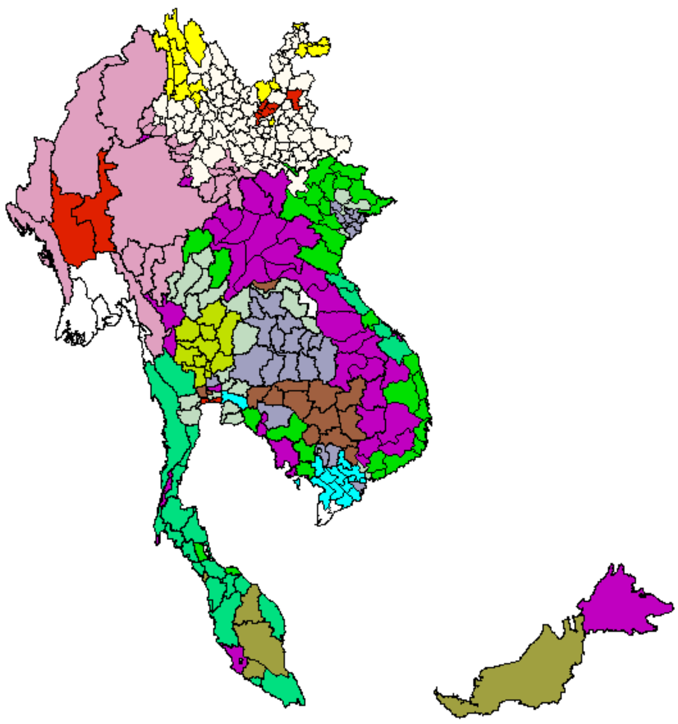
[40] The overall SEA area will see a negative impact equal to -4.9%.

	NPP per capita	NPP	Population
	annual growth rates (2005-15)		
Yunnan	**0.202**	**0.497**	**0.295**
Other SEA countries	**-1.149**	**0.028**	**1.177**
Total SEA	**-0.981**	**0.064**	**1.044**

As the population of Yunnan is expected to increase only 0.29%, against 1.18% in the other SEA countries, the combined results are evident.
In other word Yunnan will take profit by the concomitance of two facts: a NPP higher increase and a population lower increase.

Emerging "areas of concern" have been identified by cluster 14, 5 and 3.

Cluster 14 covers most of the Cambodia districts; there an expected remarkable decrease of per capita NPP in areas already rather densely populated, combined with a rapid population growth should certainly be identified as a "predisposition factor".
The IISA/FAO GAEZ plates confirm a climate change strong negative impact in the future. *(Legend must be added)*



The area is also seriously affected, as confirmed also by Dilley/WB images data processing, by flood hazards and, although not in such strong way, by drought risks.
A separate socio-economic classification, described in the next pages, fully confirms the above concerns.

The central Myanmar agricultural plains are identified by **cluster 5** as a second "area of concern". The main concerns are related to a low per capita staple food production (rice+maize as a proxy has been used).
A NDVI high interannual variability during the growing season combined with a high risk of recurrent drought are both elements triggering for HSPs. Also in this case a separate socio-economic classification, described in the following pages, fully confirms the above concerns, adding additional predisposition patterns.

A third cluster covers the full Laos, and some Vietnamese and Cambodian areas contiguous to the Laotian south eastern borders. The cluster profile is characterised by an extremely high decrease of per capita NPP during the next ten years. A glance to the socio-economic classification, described in the following pages, adds additional concerns, identifying Lao as the most vulnerable area **(cluster 3)**

The SEA two bigger delta area (Mekong [**cluster 12**] and Red River [**cluster 2**]), already extremely populated, will need in the future to cope with a rather negative climate change impact and by persistent heavy risks of flood hazards.
On the contrary the lower part of the Ayeyarwady River and its delta are threatened by a drought hazards (**cluster 8**).

According to this overall SEA classification the Chinese Yunnan province is classified in clusters characterised by a positive increase of per capita NPP (confirmed also by IIASA/FAO GAEZ plates data processing) (see **cluster 1 and 6**): however most of the major concerns are related to a NDVI very high interannual variability during the growing season. For a Yunnan more detailed classification, with inclusion of socio-economic indicators, see in the next pages a separate classification.

The cluster profiles are quantitatively described in the table here below

CLASS	NUM	POP_DENS	POPGRWDB	staple_pc	mNPP05	mNPPpcVar	NDVI_yave	NDVI_ia_var	13MAIZ_yld	SCRFIc_yld	Clim_I
14	14	257.5 --	2.09 ++++	1.12 ~~~	1984 ~~~	-2.02 --	0.532 ~~~	0.135 --	3.24 ++	4.25 ++	-10.10 --
5	9	257.3 --	1.27 ++	0.39 --	1654 ----	-1.55 --	0.455 --	0.241 ++	1.68 ~~~	1.76 --	-6.45 ~~~
3	39	174.3 --	3.16 ++++	0.62 --	2260 ++	-3.10 ----	0.65 ++++	0.165 --	0.57 --	1.04 --	-5.01 ~~~
7	31	189.6 --	1.27 ++	0.82 --	2017 ~~~	-1.25 --	0.6 ++	0.124 --	0.56 --	1.11 --	-13.30 --
12	12	458.8 ~~~	1.10 ~~~	2.91 ++++	1996 ~~~	-1.15 ~~~	0.478 --	0.182 --	2.16 ~~~	5.32 ++++	-8.45 --
8	7	284.2 ~~~	0.89 ~~~	1.88 ++	2367 ++++	-1.07 ~~~	0.473 --	0.367 ++++	3.14 ++	3.62 ++	-1.28 ++
11	22	51.4 --	0.82 ~~~	0.91 ~~~	1947 ~~~	-0.96 ~~~	0.609 ++	0.352 ++++	0.71 --	1.10 --	-1.30 ++
4	23	191.9 --	0.76 --	0.42 --	2400 ++++	-0.74 ++	0.67 ++++	0.106 --	0.53 --	1.01 --	-7.59 --
13	5	64.3 --	0.56 --	0.27 --	2477 ++++	-0.49 ++	0.703 ++++	0.07 ----	0.28 --	0.65 --	29.79 ++++
2	27	519.0 ~~~	0.55 --	1.34 ++	1927 --	-0.50 ++	0.446 --	0.147 --	5.16 ++++	5.38 ++++	-9.11 --
9	22	185.3 --	0.36 --	1.07 ~~~	1927 ~~~	-0.30 ++	0.546 ~~~	0.156 --	2.63 ++	2.62 ~~~	-8.37 --
6	17	181.0 --	-0.05 --	0.91 ~~~	1454 ----	0.18 ++++	0.476 --	0.417 ++++	1.60 ~~~	1.46 --	44.82 ++++
1	87	143.8 --	-0.20 ----	0.87 --	1548 ----	0.30 ++++	0.499 --	0.341 ++++	0.23 --	0.25 ----	-1.12 ++
15	11	114.8 --	-0.35 ----	3.85 ++++	1733 --	0.45 ++++	0.536 ~~~	0.152 --	4.63 ++++	4.49 ++	-4.67 ~~~
10	5	3391.9 ++++	2.19 ++++	0.11 ----	2001 ~~~	-2.15 ----	0.433 ----	0.135 --	3.05 ++	4.40 ++	-8.99 --
OVERALL PROFILE	331	432.6	0.98	1.09	1990	-0.98	0.536	0.209	1.98	2.52	-4.88

The profiles of the supplementary variables are described here below

CLASS	NUM	FLOOD	DROU_ave	CYCL_ave
14	14	8.41 ++	4.82 ~~~	0.34 --
5	9	1.81 ----	7.25 ++	0.00 --
3	39	6.24 ~~~	4.25 ~~~	1.86 ~~~
7	31	7.82 ++	3.43 --	4.50 ++++
12	12	8.19 ++	6.04 ++	0.00 --
8	7	0.80 ----	9.42 ++++	0.13 --
11	22	1.77 ----	6.33 ++	0.33 --
4	23	8.01 ++	1.86 --	1.81 ~~~
13	5	6.03 ~~~	0.22 ----	0.00 --
2	27	8.49 ++	3.77 --	2.75 ++
9	22	7.78 ++	5.34 ~~~	2.35 ++
6	17	3.95 --	2.21 --	0.00 --
1	87	2.28 --	3.79 --	0.07 --
15	11	8.43 ++	8.38 ++++	0.00 --
10	5	8.14 ++	3.63 --	1.34 ~~~
OVERALL PROFILE	331	5.74	4.75	1.40

Two additional classifications

Two additional classifications (separately for Yunnan and the other SEA countries) have been carried out and described in the next pages. These classifications benefit from the use of a set of socio-economic indicators not comparatively available for the whole SEA area.

SEA area, excluding Yunnan

The classification has emphasised the presence of two very consistent clusters characterised by the following common patterns:
Very high levels of

- rural population,
- dependency rate
- and infant mortality rate.

Very low levels of access to safe water
(these indicators have been used as active variables in the classification)

These patterns seem concomitant with the lowest level of

- access to sanitation and

- adult literacy rate

(these indicators have been used as supplementary [non active] variables in the classification).

The above patterns are the typical ingredients of a poverty recipe, as confirmed by the highest poverty rate level of these two clusters.

.

Although presenting similar profiles for the above indicators, these two clusters suggest different type/level of "area of concerns", as soon as other indicators are considered. .

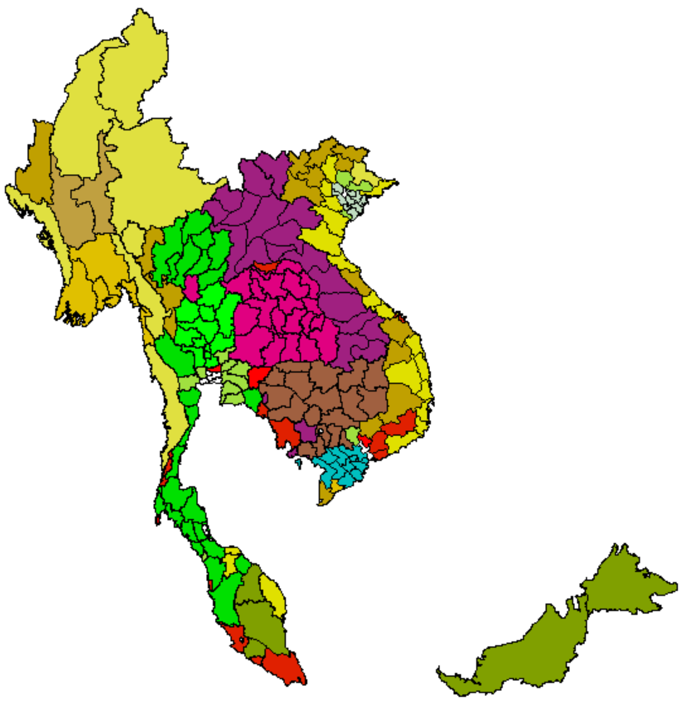
.

Cluster 9 includes most of the Cambodian districts. These areas, in spite of actually performing well in term of cereals production, but being already relatively densely populated and with an expected significant population growth rate, will face in the next 10 years a significant per capita decrease of the NPP.

This trend is confirmed by another FAO source[41], estimating that in this area – during the current century - the impacts of climate change on cereals production will be worryingly negative (-14.5%). Considering that, if we exclude Yunnan for the computation, the remaining SEA overall area will be losing food production capacity due to climate change for about -6.5%, we must conclude that the Cambodian area will be one of the most penalised.

The fact that flood hazards reach in these areas high scores[42] adds additional concerns on their fragility.

Cluster 1, on the contrary, identifies areas where - although expected to be affected by a very high decrease of the per capita NPP[43] and less affected by negative climate change impact - , the current low-densely population will probably cope in an easier way. A higher per capita livestock-unit level will probably facilitate the task. However these areas are relatively exposed to Cyclone hazards[44],and still strongly affected by malaria. *(Legend must be added)*



[41] for the applied methodology and definition: see IIASA/FAO GAEZ, pages 103-107

[42] see indicator computed from Dilley/WB digital maps

[43] mainly due to very high population growth rates

[44] see again Dilley/WB op cit

Cluster 7, located mainly in North-western Vietnam is another area of concerns. The cereal current relatively low performances[45], combined with the following patterns: a) high population growth rates, b) per capita NPP negative growth rate and c) high negative climate impact (-12.1%), is forging a predisposition to HSPs. The high exposure to flood and cyclone hazard will increase this probability. Let add to the vulnerability basket the fact that malaria is still an endemic disease,

In the Myanmar central plains too predispositions to hotspots are taking form. This densely populated area already shows a low per capita rice+maize production. The current cereal performances, already not high, will have to face with a per capita expected decrease of NPP, inside an overall framework of a rather negative climate impact (-8.8%).
As well known from literature, and well demonstrated too when processing Dilley/WB raster images, drought hazards are meaningfully treating these plains. The current poverty rate levels confirm the above profile (see **cluster 17**).

The downstream Ayeyarwady plains and its Delta (**cluster 15**) show some predispositions similar to those just identified for the Myanmar central plains. These areas, already affected by a higher population density and, although - in general - beneficing from good cereal performances and per capita cereal availability, are affected by a very high interannual NDVI variability during the growing season.
How much the growing season could be unreliable is confirmed by the extremely high drought hazard scores[46]. This high interannual variability, as insisting into areas characterised by significant poverty rate levels and certainly affecting yearly crop performances, could seriously treat farmers' resilience margins.

Most of the remaining Myanmar territory, together with the Vietnamese north western areas bordering Chinese Guangxi, shows similar interannual NDVI variability, but within a relatively lower population density and a better environmental context (see **cluster 8**)

Up the here the most relevant "areas of concern" emerging from the classification.

The classification, although using a limited set of indicator, identifies also some peculiarities for other SEA areas.

The Vietnamese part of Mekong Delta (the so called: *Cuu Long*, "Nine Dragons") is identified for its high agricultural performances combined with an extreme dense population. Its vulnerability is confirmed by a high predisposition both to flood and drought hazards. In a long term perspective, the climate change impact will affect negatively this areas (-6.5%) and it is expected that in the next ten years the per capita NPP will decrease (-1.1% yearly) . Access to safe water is still a problem (see **cluster 12)**
Most of the Coastal Viet Nam (**cluster 2**), already densely populated, will be affected by climate change impact and a significant decrease of the per capita NPP. These facts should be considered in relation with an already low level of per capita rice+maize production and a persisting high risk of floods and cyclones Malaria rate is still high.
Cyclones are also hampering the densely populated North Vietnamese Red River Delta, combined with a persistent flood hazard (**cluster 10**)
Thailand, interestingly, results divided in three main parts.
The Easter one, mostly exposed to a concomitance of floods and drought hazards will be, in long terms, more affected by negative climate change impact (-11.4%) although if, according to other

[45] this cluster is affected by one of the lowest per capita cereal production (rice+maize have been used as a proxy)
[46] according, again, to Dilley/WB images data processing

sources, a stable per capita NPP during the next ten years is expected. However poverty is still a problem there (**cluster 4**)
The northern and southern parts, less favourite in term of per capita cereals production, show better trends. Floods are the most relevant risks (**cluster 3**)
The central, high productive part, seems in the future the most favourite but threatened by a high level of flood and drought hazards (**cluster 5**)
A forth, smaller area has been identified: located near the Cambidian wastern borders is affected mainly cyclone hazards (**cluster 13).**
Lower Peninsula and Island Malaysia belong to a separate cluster characterised by an apparent positive climate change impact. However the reliability of this cluster should be considered scarce, as few reliable information are available for the island part (**cluster 14**).
Finally two spotty clusters, mainly due to dubious reliability of official data, have been identified and must not be considered (**clusters 6 and 16**).
The administrative areas of the big cities, when not included in bigger areas, have been automatically sorted out in a separate group by the clustering procedures (**cluster 11**).

The cluster profiles are quantitatively described in the table here below

CLASS	NUM	RuralPopRate	POPDens	POPGRW	DepRate	SafeWater	InfantMortR	PovertyR	Malaria	r+mKG/d_pc	LU_pc
1	22	83.72 ++	38.0 --	3.04 ++++	80.71 ++++	49.19 ----	81.04 ++++	38.25 ++++	5.26 ++	1.09 ~~~	0.50 ++++
9	18	89.81 ++	144.5 --	1.55 ++	67.45 ++++	23.84 ----	97.96 ++++	29.91 ++++	0.55 --	1.16 ~~~	0.27 ++
7	15	83.28 ++	97.3 --	1.58 ++	63.84 ++++	69.71 --	45.52 ++	21.94 ++	20.44 ++++	0.87 --	0.23 ++
17	2	78.04 ++	156.8 --	1.01 ~~~	56.01 ++	77.04 ~~~	52.77 ++	28.58 ++++	1.00 --	0.45 --	0.23 ++
15	5	67.43 ~~~	293.1 --	0.87 --	55.90 ++	75.36 ~~~	56.98 ++	21.04 ++	1.30 --	1.91 ++	0.16 ~~~
8	8	82.07 ++	49.1 --	0.84 --	56.15 ++	63.09 --	64.38 ++++	17.58 ~~~	4.75 ++	0.91 --	0.29 ++
12	10	82.90 ++	508.3 ~~~	1.07 ~~~	50.24 ~~~	40.39 ----	34.73 ~~~	13.50 --	0.96 --	2.84 ++++	0.08 --
2	19	79.64 ++	206.0 --	1.13 ~~~	60.47 ++	85.20 ++	36.23 ~~~	16.99 ~~~	4.48 ++	0.75 --	0.20 ~~~
4	20	83.08 ++	121.5 --	0.26 --	41.49 --	99.85 ++	6.01 --	28.01 ++	0.44 --	1.36 ++	0.16 ~~~
3	25	71.01 ~~~	100.7 --	0.38 --	42.16 --	97.28 ++	6.37 --	8.68 --	1.73 ~~~	0.69 --	0.13 --
5	12	80.34 ++	130.3 --	-0.29 ----	37.23 ----	97.92 ++	7.68 --	10.85 --	0.32 --	3.72 ++++	0.15 --
13	13	75.32 ~~~	278.3 --	0.85 --	44.29 --	96.21 ++	10.95 --	5.91 --	2.27 ~~~	1.17 ~~~	0.31 ++++
10	9	87.02 ++	1086.7 ++	0.79 --	51.23 ~~~	91.45 ++	28.14 ~~~	7.84 --	1.55 --	1.26 ~~~	0.14 --
14	5	54.73 --	49.2 --	1.28 ~~~	61.80 ++	70.73 --	7.32 --	11.87 --	1.37 --	0.17 --	0.11 --
Overall Profile	207	71.12	480.3	1.13	51.63	79.44	33.12	16.35	2.73	1.13	0.18
6	12	37.97 ----	412.1 ~~~	2.07 ++	50.74 ~~~	94.06 ++	12.40 --	4.53 ----	1.53 --	0.29 --	0.19 ~~~
16	4	66.88 ~~~	292.1 --	5.21 ++++	38.54 ----	97.69 ++	8.31 --	8.04 --	1.30 --	1.27 ~~~	0.09 --
11	8	18.58 ----	3102.0 ++++	2.19 ++++	32.95 ----	98.33 ++	10.68 --	4.35 ----	0.26 --	0.22 --	0.03 ----

CLASS	NUM	mNPPpcVar	NDVI_yave	NDVI_ia_var	13MAIZ_yld	SCRFIc_yld	Clim_Impact

1	22	-2.99 ----	0.64 ++++	0.25 ++	0.64 --	0.99 --	-3.68 ++
9	18	-1.55 --	0.49 --	0.15 --	3.08 ++	4.79 ++	-14.54 --
7	15	-1.58 --	0.60 ++	0.20 ~~~	0.29 ----	0.63 ----	-12.14 --
17	2	-1.44 --	0.46 --	0.24 ++	1.74 --	1.80 --	-8.77 --
15	5	-1.06 ~~~	0.48 --	0.38 ++++	3.26 ++	3.75 ++	-0.29 ++
8	8	-0.96 ~~~	0.61 ++	0.34 ++++	0.81 --	1.26 --	-2.76 ++
12	10	-1.14 ~~~	0.49 --	0.18 ~~~	2.25 ~~~	5.51 ++++	-6.44 ~~~
2	19	-1.09 ~~~	0.61 ++	0.10 --	0.51 --	0.97 --	-13.40 --
4	20	-0.17 ++++	0.48 --	0.15 --	4.96 ++++	4.54 ++	-11.47 --
3	25	-0.39 ++	0.66 ++++	0.14 --	0.90 --	1.40 --	-8.24 ~~~
5	12	0.41 ++++	0.53 ~~~	0.15 --	4.64 ++++	4.56 ++	-4.98 ~~~
13	13	-0.76 ++	0.54 ~~~	0.14 --	2.64 ~~~	3.17 ~~~	-5.10 ~~~
10	9	-0.78 ++	0.41 ----	0.14 --	5.31 ++++	5.45 ++++	-5.58 ~~~
14	5	-1.23 ~~~	0.72 ++++	0.07 ----	0.23 ----	0.56 ----	24.52 ++++
Overall Profile	207	-1.15	0.54	0.18	2.25	2.88	-6.57
6	12	-2.02 --	0.63 ++	0.12 --	0.56 --	1.06 --	-7.99 ~~~
16	4	-5.15 ----	0.57 ++	0.13 --	2.38 ~~~	3.78 ++	-8.06 ~~~
11	8	-2.14 ----	0.43 ----	0.13 --	3.00 ++	4.28 ++	-8.81 --

CLASS	NUM	mNPPpcVar	NDVI_yave	NDVI_ia_var	13MAIZ_yld	SCRFIc_yld	Clim_Impact
1	22	-2.99 ----	0.64 ++++	0.25 ++	0.64 --	0.99 --	-3.68 ++
9	18	-1.55 --	0.49 --	0.15 --	3.08 ++	4.79 ++	-14.54 --
7	15	-1.58 --	0.60 ++	0.20 ~~~	0.29 ----	0.63 ----	-12.14 --
17	2	-1.44 --	0.46 --	0.24 ++	1.74 --	1.80 --	-8.77 --
15	5	-1.06 ~~~	0.48 --	0.38 ++++	3.26 ++	3.75 ++	-0.29 ++
8	8	-0.96 ~~~	0.61 ++	0.34 ++++	0.81 --	1.26 --	-2.76 ++
12	10	-1.14 ~~~	0.49 --	0.18 ~~~	2.25 ~~~	5.51 ++++	-6.44 ~~~
2	19	-1.09 ~~~	0.61 ++	0.10 --	0.51 --	0.97 --	-13.40 --
4	20	-0.17 ++++	0.48 --	0.15 --	4.96 ++++	4.54 ++	-11.47 --
3	25	-0.39 ++	0.66 ++++	0.14 --	0.90 --	1.40 --	-8.24 ~~~
5	12	0.41 ++++	0.53 ~~~	0.15 --	4.64 ++++	4.56 ++	-4.98 ~~~
13	13	-0.76 ++	0.54 ~~~	0.14 --	2.64 ~~~	3.17 ~~~	-5.10 ~~~
10	9	-0.78 ++	0.41 ----	0.14 --	5.31 ++++	5.45 ++++	-5.58 ~~~

14	5	-1.23 ~~~	0.72 ++++	0.07 ----	0.23 ----	0.56 ----	24.52 ++++
Overall Profile 207		-1.15	0.54	0.18	2.25	2.88	-6.57
6	12	-2.02 --	0.63 ++	0.12 --	0.56 --	1.06 --	-7.99 ~~~
16	4	-5.15 ----	0.57 ++	0.13 --	2.38 ~~~	3.78 ++	-8.06 ~~~
11	8	-2.14 ----	0.43 ----	0.13 --	3.00 ++	4.28 ++	-8.81 --

The profiles of the supplementary variables are described here below

CLASS	NUM	SexRatio	Sanitation	Literacy	FLOOD_ave	DROU_ave	CYCL_ave
1	22	97.3 ~~~	22.71 ----	64.08 ----	5.44 --	4.19 --	2.45 ++
9	18	91.2 ----	15.42 ----	65.80 ----	8.67 ++	4.23 ~~~	0.04 --
7	15	99.4 ++	77.29 --	83.85 --	7.96 ++	4.71 ~~~	3.50 ++
17	2	97.2 --	85.10 ~~~	94.21 ++	1.60 ----	8.81 ++++	0.00 --
15	5	100.0 ++	75.17 --	94.98 ++	0.37 ----	9.86 ++++	0.00 --
8	8	98.6 ~~~	74.97 --	79.46 --	1.72 ----	5.61 ~~~	0.62 --
12	10	96.3 --	88.36 ++	87.81 ~~~	8.13 ++	6.41 ++	0.00 --
2	19	97.7 ~~~	73.00 --	87.97 ~~~	8.45 ++	3.30 --	6.38 ++++
4	20	99.8 ++	98.80 ++	89.06 ~~~	9.41 ++	6.46 ++	0.50 --
3	25	99.1 ++	98.55 ++	98.18 ++	7.10 ++	3.91 --	0.13 --
5	12	97.8 ~~~	99.29 ++	92.73 ++	8.39 ++	7.97 ++	0.00 --
13	13	97.9 ~~~	95.08 ++	96.71 ++	8.32 ++	3.30 --	2.87 ++
10	9	94.8 --	95.89 ++	94.00 ++	6.71 ~~~	0.00 ----	7.13 ++++
14	5	104.3 ++++	96.99 ++	89.41 ~~~	3.86 --	0.84 ----	0.00 --
Overall Profile 207		98.0	82.87	6.37	4.92	1.64	
6	12	101.9 ++++	91.36 ++	94.40 ++	8.28 ++	2.56 --	0.88 --
16	4	96.0 --	94.52 ++	85.20 ~~~	8.81 ++	4.67 ~~~	0.00 --
11	8	95.1 --	98.03 ++	77.94 --	7.92 ++	3.68 --	1.18 ~~~

Yunnan classification

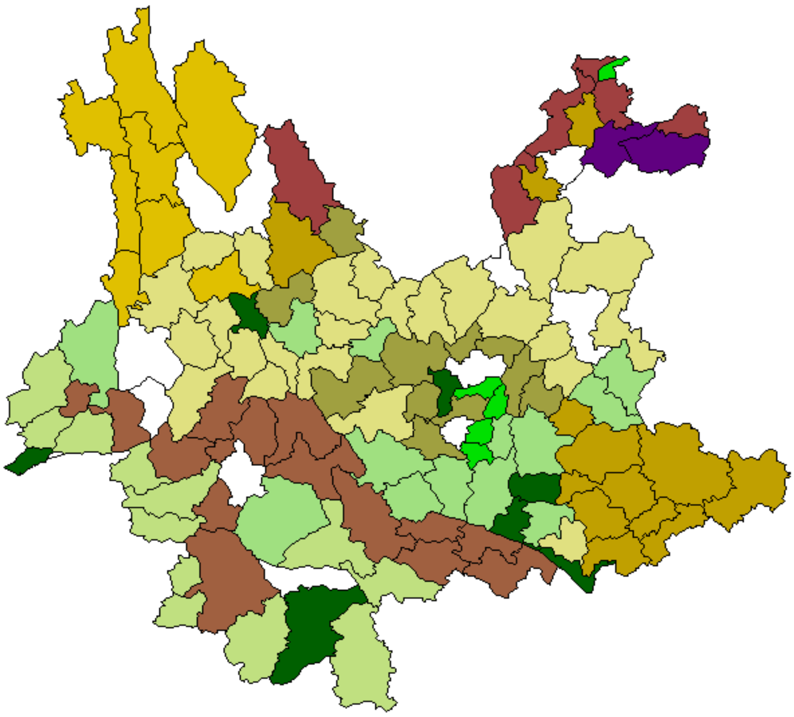
In order to identify "area of concerns" for Yunnan, a separate data set – due to the actual lack of comparable date with the other SEA countries - has been used.
Data have been extracted from the "County Statistic Yearbooks" and in general make reference to 2000 or nearer years for allowing some comparison with the socio-economic classification of the other SEA countries.

In this data set, in analogy to the previous SEA one, livelihood indicators, environmental levels and performances are merged and analysed together

Yunnan, as already observed, will be positively affected - during the next ten years and in a long term period too - by climatic changes. According to FAO/IASA estimation the climate impact on the overall Yunnan will reach 5%. This is partially confirmed by the recent FAO minimum NPP estimation. It is expected that the per capita NPP will yearly increase in the next ten years of about 0.20%, against a yearly worsening, in the remaining SEA area, of about 1.15%.

The most poor and remote areas of Yunnan will benefit more. However the clustering analysis has confirmed a strong dichotomy inside this Chinese province.

The analysis results show two Yunnans: a first one very poor, with a) very low access to services, b) scarce per capita cereal production and c) very low consumption of meat and oil; a second one better equipped, performing better and with a better food production composition. *(Legend must be added)*



The most crucial "areas of concern" are detectable in the Wulian Feng densely populated[47] areas.

[47] more than double when compared with the overall Yunnan

A very low per capita "grains" production (less than 300 Kg per year) combined with a) very few extra-agricultural opportunities[48], b) low access to electricity and telephones, c) extreme low saving capacity and d) in presence of high risks of floods, creates the ideal predisposition to poverty related HSPs (**see clusters 10 and 12).**

The average per capita GDPs[49] varies between 1033 (cluster 12) and 1391 (cluster 10)

Worth to be noted that a bit less than 9% of the total Yunnan population lives in this area. **Cluster 10**, in particular, is affected by a NDVI very high interannual variability during the growing season, adding addition concerns.

HSPs predisposition characterises other Yunnan areas too.

It is the case of clusters **1, 6 and 3** (see map). They include only counties indicated as "poverty stricken" in the national list[50]. Their average per capita GDP varies between 1800 (cluster 1) and 2500 (cluster 2).

A NDVI very high interannual variability during the growing season characterises also the areas of the Wuliang shan and Laobie shan; this fact is confirmed too by Dilley/WB data processing showing a very high exposure to drought risks. Low per capita grain performances, scarcity of meat and oil, scarce access to electricity and to telephones, all these are the right ingredients for a poverty recipe, and suitable for a strong predisposition to HSPs **(cluster 1)**

Other two areas of concerns are locates respectively in the Yunnan left upper corner and right lower corned. Different altitudes and morphological patterns imply different predisposition.
The high mountainous areas identified by **cluster 3** are mainly menaces by a NDVI very high interannual variability during the growing season, while the relatively low lands of the right lover corner **(cluster 6)** are menaced by flood hazards.

The cluster profiles are quantitatively described in the table here below

[48] as detectable through a primary and secondary industrial GDP per capita
[49] Yuan per year (2000)
[50] the provincial list includes also counties not shown in the national list

CLASS	NUM	%RuralPop	%HHTeleph	RpcGrain	RpcMeat	T_GDPpcY	TpcSavingY	poor	mNPPpcVar	NDVI_yave	NDVI_ia_var	13MAIZ_yld	SCRFIc_yld	Clim_Impact
12	2	95.4	6.1	240	33.3	1033	334	1	0.47	0.47	0.333	3.823	3.452	23.97
		++	----	----	----	--	--	++	++	--	~~~	++++	++++	++
10	6	94.8	10.3	297	39.6	1391	602	1	0.78	0.458	0.451	0.846	0.749	6.558
		++	--	----	--	--	--	++	++	--	++++	++	++	~~~
1	14	90.9	14.2	372	32.7	1814	842	1	0.45	0.55	0.379	0	0	-0.106
		++	--	--	----	--	--	++	++	++	++	--	--	--
6	12	92.9	14.4	346	46.8	1930	1007	1	0.43	0.49	0.221	0.252	0.236	-3.83
		++	--	--	--	--	--	++	++	--	----	~~~	~~~	--
3	8	88.1	16.1	447	49.4	2327	1431	1	0.31	0.494	0.448	0.031	0.061	86.66
		~~	~~~	++	--	--	~~~	++	~~~	~~~	++++	--	--	++++
2	17	93.1	15.4	437	81.7	2549	1189	1	0.65	0.523	0.371	0.005	0.03	8.126
		++	--	++	++	--	--	++	++	++	++	--	--	~~~
11	7	91.3	10.1	382	89.2	2552	1149	0.48	0.05	0.44	0.335	0.357	0.311	-0.594
		++	--	~~~	++++	--	--	--	--	----	~~~	~~~	~~~	--
5	12	80.9	28.5	481	35.0	3077	2003	0.53	-1.05	0.608	0.381	0.053	0.157	1.468
		----	++	++++	--	~~~	++	~~~	----	++++	++	--	--	~~~
9	13	89.3	20.1	401	58.5	3552	1984	0	0.25	0.517	0.338	0.022	0.062	-6.554
		~~	~~~	~~~	~~~	++	++	----	~~~	++	~~~	--	--	--
7	11	84.9	27.7	513	93.5	5604	3177	0	-0.18	0.499	0.349	0.206	0.307	5.088
		--	++	++++	++++	++++	++++	----	--	~~~	~~~	~~~	~~~	~~~
4	5	86.9	34.7	271	62.9	6069	4346	0	-0.23	0.443	0.478	0.477	0.835	14.4
		--	++++	----	~~~	++++	++++	----	--	----	++++	~~~	++	++
8	7	56.8	62.7	520	81.9	8935	6806	0	-0.83	0.527	0.309	0.226	0.31	4.229
		----	++++	++++	++	++++	++++	----	----	++	--	~~~	~~~	~~~
PROFILO GLOBALE	#	89.2	18.3	393	59.9	2949	1644	0.63	0.20	0.504	0.347	0.385	0.387	4.99

The profiles of the supplementary variables are described here below

RurHHsize	RpcOil	GDP1pcY	GDP2pcY	R_pcElectr	FLOOD_ave_ave	DROU_ave_ave	CYCL_ave	CLASS	NUM
4.3	1.8	590.9	170	0	7.00	1.29	0.00	12	2
++	--	----	--	--	++++	--	--		
4.2	4.9	###	311	0.01	6.22	2.05	0.00	10	6
~~	--	--	--	--	++++	--	--		
4.5	4.5	970.5	398	0	1.57	7.32	0.00	1	14
++	--	--	--	--	--	++++	--		
4.4	6.6	892.7	501	0.01	6.00	1.77	0.32	6	12
++	~~~	--	--	--	++++	--	++		
4.4	5.1	1171.9	574	0.01	1.16	3.78	0.00	3	8
++	--	~~~	--	~~~	--	~~~	--		
4.1	7.2	###	535	0.01	0.49	4.36	0.00	2	17
--	~~~	~~~	--	~~~	--	++	--		
4.0	6.3	###	842	0.01	1.42	2.09	0.00	11	7
--	~~~	--	~~~	~~~	--	--	--		
4.7	9.3	###	713	0	0.36	7.07	0.20	5	12
++++	~~~	++	~~~	--	--	++++	++		
4.1	17.5	###	1314	0.01	0.56	3.78	0.00	9	13
--	++	~~~	++	~~~	--	~~~	--		
3.9	10.9	###	2043	0.02	0.49	4.42	0.00	7	11
--	++	++++	++	++	--	++	--		
3.4	5.1	###	2773	0.06	1.62	2.00	0.00	4	5
----	--	++++	++++	++++	--	--	--		
4.2	6.1	###	4095	0.02	0.80	4.02	0.20	8	7
~~	~~~	++++	++++	++	--	~~~	++		
4.2	7.9	1217.1	946	0.01	2.28	3.78	0.06		

Chapter 3

The outcomes of several Hotspots HSPs general studies and synthetic environmental indicators related to SE Asia will be shortly analysed.
Emphasis in put on their potentiality of assessing poverty-related situations and –possibly- their dynamic in order to identify poverty hotspots before they reach a critical status[51].

In particular (a) Petschel-Held's Environmental syndromes, (b) Maxx Dilley's disaster hotspots, (c) the Yale/Columbia Environmental Performance Index (Pilot 2006) and Environmental Sustainability Index, and finally (d) UNDP's Human Development Index will be evaluated, making reference to SEA countries.

In spite of the fact that *"for FAO* [hotspots] *refers to adverse aspects of the interface between agricultural activities and environmental processes*", it seems challenging to examine this interface under a poverty-related magnifying-glass.

We have already noted that EG-EN are not necessary related to poverty; for instances three of the "Environmental Syndromes" identified by Petschel-Held's *"occur in both industrialised and developing countries"*(GAIA; 1/2004, page 43), namely: Dust bowl, Overexploitation and Aral See syndromes even "*prevail in industrialised countries"* (ibid, page 46).
And let us repeat: in industrialised countries the *"capital-intensive and profit-oriented agricultural overuse"* has few to do with the dynamic of poverty-related situations. The primary concerns are not the poor but the future of the entire society.

The most recent environmental-related HSP literature is more and more verted to risks and disasters. It's evident that the poor will pay most of the costs and the "flash points" will more quickly emerge between the poor, and between them the poorest; the recent case of New Orleans is self speaking.
The hurricane hit New Orleans' black people harder than its whites. Not only the poor black area was flooded, but also the middle-class black district. As the high ground was limited in the city, the whites – who were rich first - built on it first. (quoted from The Economist, vol. 378, n.8467, page 41).
This case study comforts the hypothesis that there is a relationship between natural/man-made disasters and a *continuum* from worse-off up to better-off.

However, and again, the poverty HSPs are a result of more multifaceted concomitances of facts and of their dynamics, which include environmental modification/changes as well as socio-economic-political actions/interactions
It happens that in many analysis on "global changes" indicators as, for instance, the Corruption Perception Index or "corruption index" are used (see again Gaia, pag 47, UNDP, 2004, page 103, or Tyndal, 2004, page 19 in electronic version).

The case of "Thai tiger" development (synthesised in the previous chapter and described a box, second part of this volume) offers a very good lesson on how much the complexity of the nature-

[51] For an extensive description of available sources and of the methodology used by the authors, make reference to the annexed file: **Operational_Appendix.zip.**
How to use it:

- Unzip **Operational Appendix.zip** in a directory
- Run **START_ME!.pdf**
- Follow inside the pdf the links to external files

human interactions can produce synergic negative outcomes. At the same time it shows, too, how much the poverty HSP approach should be a result of different sciences; difficulties and fascination needed to follow this path should be considered.

Emphasis is brought mainly on the rather complicated balance between kind of information we dispose and kind of information we would like to dispose, at which level of details we dispose or we would like to dispose (i.e. national, subnational, grided with witch resolutions, and so on).

However another pivotal point should be attentively considered: the types of data reporting (anecdotal, qualitative and quantitative)

This perception was already clear when, few years ago, we wrote.

> "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……
> ….. 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". (See FAO, 2003, EG-EN)

In the following pages we will try to understand how much has been done along this difficult path (with particular reference to SEA countries).

Since the publication of M H Glantz's Report: "Guidelines for Establishing Audits of AGricultural ENvironmental (AG-EN) Hotspots" many, very important and different approaches have been developed/improved.

Common between them is the need, in the identification of HSPs, of moving from national to -> sub-national levels -> .. -> up to some resolution-level of geo grid.
How to cope with information collected at different levels, and how to merge/overlay using geographical interpolation models is still one of the most crucial problem.

A second common characteristic, once defined the indicators to be used for a HSP identification/analysis, is which type of statistical tools could be used to carry out the analysis (for building, in general, "composite indexes" or to produce cluster profiles).

(a) Petschel-Held's Environmental syndromes

Glantz'Guidelines made reference to the basic researches developed at the Posdam Institute for Climate Impact Research (PIK).
In a recent "first panoramic view" of the syndromes of **global changes**, looking for the *"functional patterns of human-nature interaction"* (i.e. the processes relating human activities and environmental changes", Lüdeke, Petschel-Held (†) and Schellenhuber summarise the main characteristics of each of them.

SEAsia, as shown in their published map (see GAIA, 2004), is an area where several multiple-syndrome HSPs can be identified.

However, due to the low resolution of the map (2 degrees of latitude by 2 degrees of longitude), these map can provide only a relative contribution for an in depth identification of SEA HSPs. On the contrary the access of their 0.5 by 0.5 degree maps (the finest original resolution by a single syndrome) could – when combined with other source's maps with finest resolution – provide a significant contribution to the above issue.

Probably the most important contributions, in view of a HSPs more detailed grid map, are the "Indicator Concepts" at the base of their Syndrome concepts (Martin Cassel-Gintz, 2003, pages 41-45).
Once identified the symptoms of the Global Change (GC) through Global Overviews (GOs) the authors use three basic "concepts": Disposition, Exposition, and Intensity.
The **Disposition** concept identifies the conditions under which the interactions between symptoms <u>can</u> become active (whether a HSP might become active)
The **Exposition** concept identifies events that have the potential to trigger a HSP in an area with a disposition to the HSP in question.
The **Intensity** measures whether HSP not-sustainable pathways (the syndromes) are actually active.

However, while indicators or proxy indicators for Disposition and Exposition concepts are relatively available, it's not the same for the Intensity measurement.

For instance, in the SEA case, the Disposition conditions and the Exposition events of the Mekong time bomb HSP can be identified.
The extensions of the flooded rice plains around the Tonle Sap and, in general, in Southern-Easter Cambodia are easily identifiable through different sources and techniques (**Disposition** conditions).
The **Exposition**, to say the events that could trigger the Mekong time bomb HSP, can be identified through scenarios of water utilisation/diversion in the Mekong upperstream (i.e. the implementation of a cascade of large dams on the Chinese upper Mekong without negotiating with the other riparian countries). But even the construction of new roads along Tonle Sap, as apparently in some area crossed by the Kampong Tom – Siem Reap road, can hamper the natural movement of the flood and consequently contribute in trigging the HSP.
To identify the **Intensity** is not so easy, although both anecdotal and sporadic quantitative information are available. For instance the concerned area is heavily affected by lack of drinkable water, and only the farmers have a clear knowledge about the relationship between the level of the flood and the replenishment of their water sources.

The same approach could be carried out in the case of the already quoted Thai case study.
Disposition conditions could be easily identified through agro-ecological and farming system zonation.
Exposition through different events (polarization of farm size, working-age migration, increasingly dependency rate, and so on) could be described.
For this HSP case study, the **intensity** of the impact could be probably measured through the intensity of the so-called "return migration" and matrix of population infra-censual flow (between small administrative areas).
The above HSP could combine Green Revolution, Asia Tiger and Favela syndromes in a multiple-syndrome HSP.

A third application could be Yunnan (dams, national parks, firewood and wildfood)

In any case, the most serious constraints, when attempting to develop such approach for SEA, come from data availability and level of their availability.

Most of the 56 indicators used by the authors for the identification of the *"syndrome-specific non-sustainable paths and disposition factors"* are, at present, non-available at the first sub-national level (admin 2); and very few information are available at (different) grid levels.

(b) Maxx Dilley's disaster hotspots
The Global Natural Disaster Risk Hotspots Project

The grid outcomes produced by IBRD/WB and Columbia University, and the related methodology might provide useful suggestion/contribution for the identification of HSPs in SE Asia.

As well know the project aims are to spatially estimate risks of human and economic losses assessing the exposure of people, infrastructure and economic activities to major natural hazard.

The **elements at risk** are (by definition): the population and the GDP per unit area.
(sources GPW/CIESIN, GDP using WB GDP-PPP data and estimated using Sachs and co-authors method)

The global distribution of six different **types of natural hazards**:
- cyclones
- flood
- drought
- landslide
- earthquake
- volcanoes

is available on digital maps (resolution 2.5'). The hazard data were prepared at a variety of spatial resolution and for varying periods (see table1, page 8, Synthesis report 2005)

According to the formula:

Disaster Risk = *f*(hazards, vulnerability)

Risk levels are estimated by combining hazard exposure with historical vulnerability (page 2), where **vulnerability** is defined ad the stress to which a given element at risk is subjected during a hazard event at a given location.

For each type of the above natural hazards a set of three maps of risk[52] have been produced:
- Mortality risk,
- Total economic loss risk,
- Economic loss risk as a proportion of GDP density (per unit area).

For an appropriate use of the digital images in view of an identification of HSPs, and particularly of poverty-related HSps, it seems important to identify which map(s) could be more significant. Mortality risk seems a too narrow criterion, and probably the total economic risk is a more appropriate one.
Doubts should be expressed about the methodology used for reallocating the GDP to subnational units (GDP subnational data are available only for few countries) and in any case a reallocation based on population distribution seems not the more appropriate.

[52] "Due to limited time period and quality of the input data the maps show distribution by deciles" the author wrote. This fact can partially limits the use of the maps as input for further analysis.

Finally three overall maps, showing the global distribution of highest-risk disaster HSPs by all hazard combined (multi-hazard index), have been produced.

In spite of the fact that these maps are mainly useful for a world-wide comparison of global risk, they could provide significant contribution in the identification of SE Asia Natural Disaster Hotspots.
According to the multi-hazard indexes, the natural disaster hotspots emerging in different parts of the SE Asia are rather the combination of different hazard:
In terms of economic loss risk the most multi-hazard combination (top 3 deciles) characterises Yunnan (from: drought, hydro and geophysical hazards), while lower combinations characterises the other countries or part of them.

A list (based on land area) of the top 60 country most exposed to Multiple Hazards (two or more hazards) showing the percent of total area and population exposed, and the max number of hazards, has been extracted from tables 1.1a and b. of *Natural Disaster Hotspots – A Global Analysis,* page 4 (©2005 The World Bank and Columbia University).
In the table here below the countries has been sorted by percent of population exposed.

Exposition to two or more hazards by country

Country	% of Total Area Exposed	%Population Exposed	Max. Number of Hazards
Cambodia	27.9%	4.4%	3
Lao People's Dem. Rep.	15.2%	12.6%	3
Myanmar	10.7%	10.4%	4
Thailand	25.2%	17.7%	2
Viet Nam	45.1%	38.7%	3
China (total)	8.4%	15.7%	3

Exposition to two or more hazards by country

Country	% of Total Area Exposed	%Population Exposed	Max. Number of Hazards
Viet Nam	45.1%	38.7%	3
Thailand	25.2%	17.7%	2
Lao People's Dem. Rep.	15.2%	12.6%	3
Myanmar	10.7%	10.4%	4
Cambodia	27.9%	4.4%	3

Note: Malaysia is not included in the top 60 countries.

Yunnan estimation are not available, however for simple comparison the Chine figure are lusted here below.

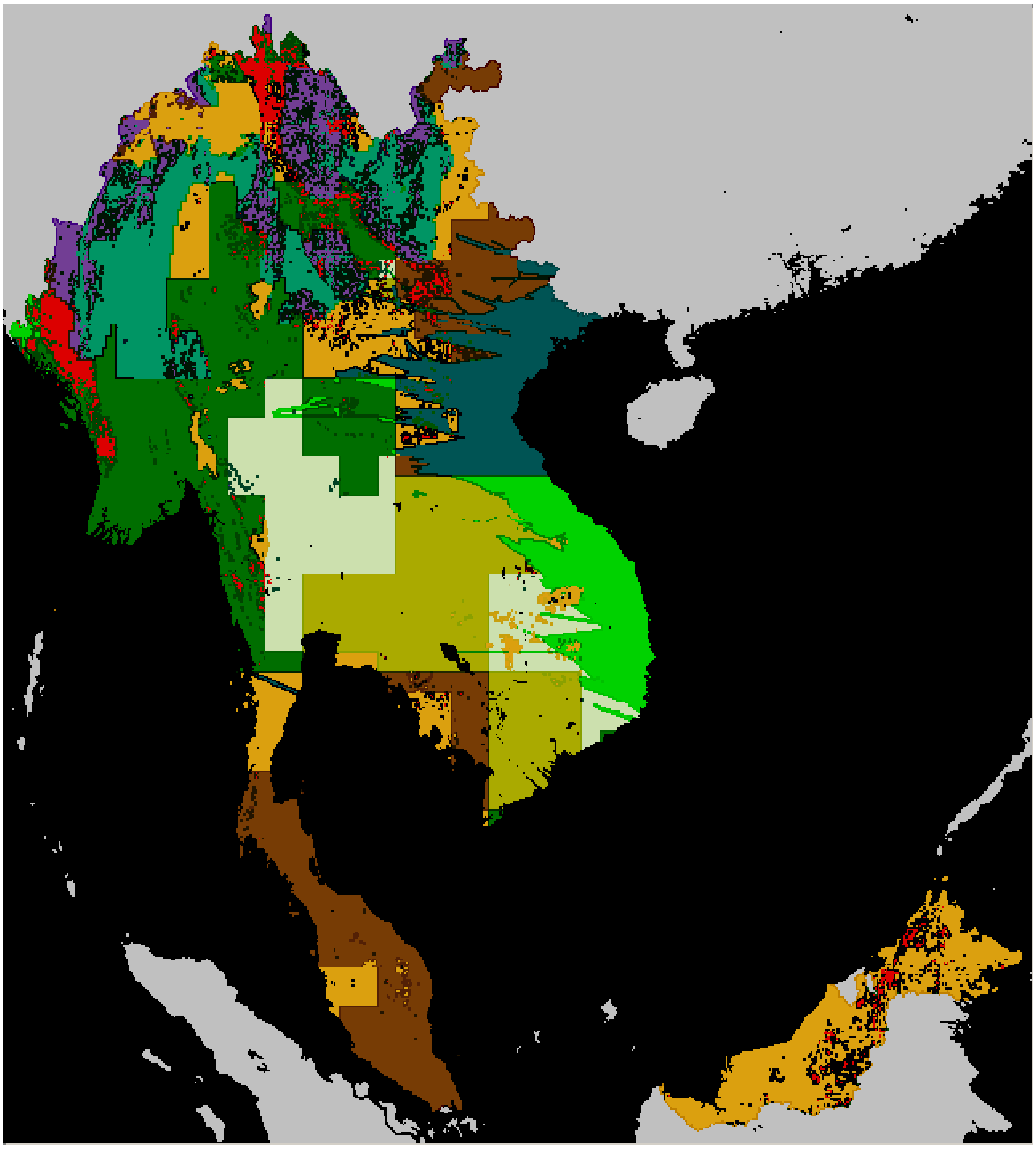
China (total)	8.4%	15.7%	3

Although the above hotspots make reference only to natural disasters it has been possible to processes these information, extract district statistics to be used together with other environmental and socio-economic indicators in order to identify “predisposition factors” and “areas of concern”.
As a collateral product of the above procedures a tentative multi hazard pixel-by-pixel classification has been produced. The results of a processing via Principal Component Analysis + Clustering are shortly described jeer below:

South East Asia - Combined disaster hazard

The RoI has been segmented into areas characterised by various combinations of hazard types. The clusters are obtained by processing via a Principal Components Analysis + Clustering the table that gives, for each pixel, the deciles to which it belongs with respect to the five types of hazard present in the RoI.
The deciles, drawn from the Dilley's hazard maps resampled to1km[53], are those relative to the **global distribution**: therefore, some deciles may be missing in SE Asia. The belonging to a given decile is treated as a **quantitative** measure of the hazard level.
Ten clusters have been identified; their spatial distribution is shown in the map here below.

A qualitative description of the classes, listing the type of hazard and its relative level is shown here below (legend colours and map colours are the same)



[53] The resampling to 1km gives an immediate (though approximate) measure of the area of each class: for an exact measure it would be necessary to reproject to an equivalent projection, or keeping into account the cosinus of the latitude. Both could be easily done, but it would instead be more interesting to weigh each pixel with its population, to get an evaluation of the amount of population affected by each combination of hazard.

CLASS01	landslide (medium) + earthquake (high)
CLASS02	landslide (medium) + drought (medium)
CLASS03	earthquake (high) + drought (medium)
CLASS04	cyclone (medium) + drought (high) + flood (high)
CLASS05	drought (high)
CLASS06	cyclone (high) + flood (medium)
CLASS07	drought (high) + flood (high)
CLASS08	drought (medium) + flood (high)
CLASS09	free from hazard
CLASS10	flood (high) + drought (medium)

For a quantitative description of the cluster the following table can be used.

	km2		cyclones	drought	flood	landslide	earthquakes
CLASS 1	167329	average [1..10]	0.212	4.697	1.45	7.181	8.635
		S.D.	5.48	6.143	5.75	5.417	5.493
CLASS 2	167730	average [1..10]	0.652	5.922	1.647	6.58	1.728
		S.D.	1.49	3.858	2.698	0.911	1.958
CLASS 3	293524	average [1..10]	0.082	5.042	1.091	0	7.818
		S.D.	0.403	3.132	1.29	0	1.749
CLASS 4	167726	average [1..10]	6.92	7.669	9.441	0.357	0.145
		S.D.	1.393	0.729	1.898	1.459	0.741
CLASS 5	453264	average [1..10]	0.245	9.257	1.155	0	0.624
		S.D.	0.8	0.689	1.467	0	1.304
CLASS 6	186110	average [1..10]	7.283	1.109	6.185	0.222	0.025
			1.682	1.008	3.73	1.134	0.244
CLASS 7	264854	average [1..10]	0.153	8.865	8.812	0	0.037
		S.D.	0.36	0.625	1.219	0	0.274
CLASS 8	321485	average [1..10]	0.085	5.729	9.188	0	0.009
		S.D.	0.279	1.482	0.948	0	0.153
CLASS 9	493373	average [1..10]	0.154	1.297	0.9	0	0.211
		S.D.	0.361	1.394	1.496	0	0.723
CLASS 10	315385	average [1..10]	0.162	0.567	9.05	0.165	0.121
		S.D.	0.369	0.71	1.159	0.98	0.593

The above "combined disaster map" has been used both for extracting statistics at district level in order to carry out the three administrative level classification, and to produce a pixel-by-pixel classification described in the previous pages.

(c) Yale/Columbia Environmental Performance Index and Environmental Sustainability Index

(c1) Environmental Performance Index

Although the Environmental Performance Index, (Pilot 2006) had been conceived as a tool for allowing an international comparison on and ranking of efforts deployed by countries for reaching a core set of environmental outcomes, many indirect – "real value" - contribution to the efforts in the identifying poverty-related HSPs in SE Asia could come form an attentive analysis of the indicators and methodology used by Yele/Columbia approach.

EPI is a composite index of current "national" environmental protection results, encompassing 16 indicators, aggregated into five "Policy Categories": Environmental Health, Air Quality, Water Resources, Biodiversity and Habitat, Productive Natural Resources, Sustainable Energy.
Important, for our HSP' issues, is the fact that the indicators have been selected as they are supposed to "tracks the "**environmental issues of concern"** (page 11).
However most of them are available and will – in most of case – continue to be available only at national level. Consequently this fact is hampering their utilisation for a practical use in the identification of HSPs at subnational level.

While the Environmental Sustainability Index (see below) was mainly focused on a wide and long-term concept of sustainability, paying particular attention to natural endowment and past environmental performances, EPI "focuses on the current environmental performances within the context of sustainability" (pilot 2006,page 7) using a proximity-to-target methodology (targets being defined, in most cases, by expert judgements). This approach offers, at least at national level, some useful indication of the high correlation between good governance and environmental success (see page 27), suggesting that – at least in the future – a HSP analysis should include indicators as "corruption", "vigor of debate on environmental issue", regulatory effectiveness" (see page 27 again). (See for instance the use of CPI (Corruption Perception Index) used as a vulnerability indicator by UNDP when computing the composite DRI (Disaster Risk Index).

Country	Rank	EPI score
Malaysia	9	83.3
Myanmar	88	57.0
Thailand	61	66.8
Viet Nam	99	54.3
Laos	102	52.9
Cambodia	110	49.7
China (all)	94	56.2
top		
New Zealand	1	88.0
bottom		
Niger	133	25.7

The list of the EPI scores by countries offers some additional suggestion (page 3).

The SEA countries ranks (according to their position between the133) appears worrying enough, most of these countries (if we exclude Malaysia) belongs to the 4th and 5th quartiles (the worst in the performances).
But probably the best suggestion for an attempt to identify "areas of concern" and HSPs come from the tables listing the different components of scarce environmental performance.
The components for each of the 6 EPI policy categories, although provided at national level, show the relative strengths and weakness for each country; providing useful indication for further investigation in view of HSPs analysis.

The table here below summarise the EPI policy categories components. For a better comparison they have been normalised according to the overall variability of each category. The observed values have been stretched between 0 and 100, where 0 is equal to the worst performance and 100 to the target full achievement.

Countries									
Policy Categories	Camb	Laos	Viet Nam	Myanmar	Thailand	Malaysa	China (all)	score variability	
Environmental Health	18.3	21.3	44.4	47.3	71.0	88.7	61.1	99.4	0.0
Air Quality	56.5	56.0	45.3	27.4	47.5	79.8	22.3	98.0	6.9
Biodiv & Habitat	82.7	76.1	42.8	42.7	60.2	71.5	68.1	88.0	5.1
Sustainable Energy	89.1	89.8	64.1	88.3	68.1	60.8	50.8	92.4	0.0
Prod.Nat.Resources	77.8	100.0	71.8	77.2	45.6	77.8	66.2	100.0	33.3
Water Resources	99.9	99.9	97.0	98.2	91.8	99.3	49.6	100.0	6.5
EPI scores	49.7	52.9	54.3	57.0	66.8	83.3	56.2		

Figure not yet normalised	< 25
	25-50
	50-70
	70-85
	> 85

The countries have been sorted according an increasing EPI, the Policy performances from overall lower to higher.
Already at first glance it is evident that, in general, the SEAsia area is characterised

- First of all by **low performances of Environmental Health** Policies (monitored through the following indicators: Child Mortality, Indoor Air Pollution, Drinking Water, SAdequate Sanitation and Urban Particles).
- The second relevant **bad performance** pattern comes from **Air Quality** Policies (monitored through Regional Ozone and again Urban Particles).
- **Scarce** performances of **Biodiversity and Habitat Policies** are relevant too, particularly in Vietnam and Myanmar. (These performance are monitored through Timber Harvest Rate, Water Consumption, Ecoregion Protection and Wilderness Protection).

Sustainable Energy Policies performances identify "areas of concern" particularly in Malaysia, Vietnam and Thailand (used indicators: Energy Efficiency, Renewable Energy and CO_2 per GDP)
The EPI referred to **Productive Natural Resources** Policies is particularly worrying when computed for Thailand, confirming the current literature. Timber harvest rate, Overfishing and Agricultural Subsidies are the indicators used for Index computation.

From the methodological point of view two lessons can be learnt.

In the introduction of this chapter we have mentioned, as a common feature of most of the hotspots/ risk analysis, the use of **"composite" indexes.**
To use or not to use weights for each indicator when computing a composite index is a common *leit-motif* in the literature. When producing a composite index, its relevance depends not only by an appropriate choice of each component (indicators) but also by their weight in the computation.
In general the composite indexes analysed in this short review don't weight the indicators (see……….), or better – let say – they use the same weight when not weighting.
The EPI approach, before computing it, carried out – as far as possible - a PCA (Principal Component Analysis) for identifying clear group of variables (corresponding to some of their

Policy Categories. The statistically derived PCA “factors loads” were used as weights for these indicators. (see page 13). (for the methodology see page 282-283)

The methodological second relevant suggestion consists in the **use of Cluster Analysis techniques** by the EPI analysts (see page 21 and in Appendix F, pages 286-87)
As well known, clustering methods are used for providing typologies of observed units described by selected indicators. The typologies are defined by degrees of similarity of conditions across these units.
While a composite index risk to be a “black box” where the reasons for a particular outcome are hidden (“Countries may have similar EPI scores but very different patterns across the ..indicators”, the EPI team wrote), the highly descriptive typologies produced through a cluster analysis – if properly carried out – can provided decision-makers with interpretation of the data in a simple and straightforward way, assisting them when drawing their policies.
These assumption seems particular relevant in SEA poverty-HSPs, where for instance the same scarce level of the overall environmental performance (as show in the above EPI summary table) is not necessary due to the same concomitance/combination of sectorial performances. The implication for the decision-makers will be, consequently – very different.

The confirmation comes, even at national level, by the spider graphs and the map (pages 22-24 of the EPI report).
Malaysia, Myanmar, Thailand and **Viet Nam** belong to a cluster (cluster 2) including countries with relatively intact natural resources systems but **growing resource pressures**. The cluster is characterised by good water systems and poor air quality.
Lao and **Cambodia** belong to a cluster including most of the Sub-Saharian Africa less developed countries and few Asian. They face “serious sustainable development challenges and **environmental health threat**” (cluster 4)
China has been analysed **as one unit** country: she belongs to a cluster (cluster 3) with the world’s most rapid industrialisation, where “pollution and resource management challenges are growing” and “air quality and biodiversity and Habitat scores are particularly low”. Many of these patterns, according to the available literature, could be attributed to Yunnan too.

Certainly a SEA more detailed (sub-national level) cluster analysis could be extremely useful for the identification of emerging “areas of concern” and HSPs,

(c2) Environmental Sustainability Index (ESI)

As both EPI and ESI have been conceived to assist decisionmakes when defining and/or monitoring environmental policies, attention is paid here to these two composite indicators as they could provide significant contribution in detecting “areas of concern” and HSPs.
In spite of the fact that certainly there is a long way before reaching the possibility of computing them at sub-national levels, their relevance is – at the time being - mainly conceptual and methodological.

While EPI, as we have seen in the previous paragraph, is an attempt for evaluating the national current environmental policies *(“EPI address the need for a gauge of policy performance in reducing environmental stresses on human health”* (page 275), ESI - on the contrary - being constructed around the concept of “sustainability”, evaluate the country’ strength and weaknesses through five “core component” : a) Environmental Systems, b) Reducing Environmental Stresses, c) Reducing Human Vulnerability, d) Social and Institutional Capacity, and finally: e) Global Stewardship; providing *“a gauge of a country’s long-term environment trajectory”* (page 275).
Each “core component” is build by a sub-set of”indicators”, each of them being the result of a sub-sub-set of “variables”.

Although, at a first glance, the diagnostic of SEA area countries provided by the ESI is similar to the EPI one, there are significant differences if we look the outcomes in a poverty-HSPs magnifying glass.

Country	Rank	ESI score
Malaysia	38	54.0
Myanmar	46	52.8
Laos	52	52.4
Cambodia	68	50.1
Thailand	73	49.7
Viet_Nam	127	42.3
China_(all)	133	38.6
top		
Finland	1	75.1
bottom		
North_Korea	146	29.2

The most evident change is related to Thailand, overtaken by Laos and Cambodia (the less performing according to EPI).

In other words, according to the Yale/Columbia assessment, Thailand is affected by more long-term environmental problems and less by current performances in reducing environmental stress, when compared with Laos and Cambodia.

This outcome seems extremely important when trying to identify poverty-related HSPs in SEA area.

The diagnostic offered by ESI, through the contribution of the five Environmental sustainability Components, provides further evidence of the Thai pulling back. The Environmental System is its weakest score component (37 when compared with a theoretically possible range 0-100).
The second weaker component is due to a scarce contribution of the reducing environmental stress” component.

ENVIRONMENTAL SUSTAINABILITY INDEX (ESI) - SEA countries								
Countries	Camb	Laos	Viet Nam	Myanmar	Thailand	Malaysia		China
Environmental Sustainability Component								
Environmental Systems	53	56	36	51	37	55		31
Reducing Environmental Stresses	58	58	45	63	49	43		42
Reducing Human Vulnerability	18	26	34	49	52	68		55
Social and Institutional Capacity	38	47	44	36	55	55		39
Global Stewardship	79	67	55	60	64	59		29
ESI scores	50.1	52.4	42.3	52.8	49.8	54.0		38.6
Component scores	< 30							
	30-40							
	40-50							
	50-60							
	> 60							

The appendix A of the report adds significant information.

The Environmental system is mainly affected by air and water quality, combined with water quantity and a relatively very high anthropogenic impact land, accompanied by scarce activities in reducing air pollution and bad natural resource management.
On the contrary Cambodia and Laos are mainly affected by "Basic Human Sustenance" (undernourished population and scarce access to drinking water) combined with scarce "social and institutional capacity".
The Viet Nam score component profile is the worst one, where the "Reducing Human Vulnerability" requests most of the attentions (and in particular the sub-component: "Reducing Environmental-Related Natural Disaster Vulnerability".

From the methodological points of view, the ESI uses equal weights at both the indicator and the variable level, justifying this decision as follows:

> *"Our argument for equal indicator weights is based on the premise that no objective mechanism exists to determine the relative importance of the different aspects of environmental sustainability. .... Moreover, the principal component analysis in section 4 demonstrates that, even if the weights are determined through statistical means, no indicator stands out as being more or less important than others"*
> (ESI report, Appendix A, page 67)

On the contrary ESI team make a large use of clustering. The SEA six countries plus China (as a whole country) are included in the two worst clusters.
Cambodia, Laos and Myanmar are includes in a cluster (ESI cluster 2) grouping the leats-developed countries, most of whom –although experiencing relatively low environmental stress – are characterised by undernurishment, lack of sanitation and safe eater supply, vulnerable to natural disasters and with a very weak institutional capacity (very low environmental governance)
On the contrary **Thailand, Viet Nam, Malaysia** and (the whole) China belong to a cluster (cluster 7) including countries with a high population density, "strained" ecological systems and a low environmental governance.

(d) UNDP's Human Development Index and Human Poverty Index-1

The UNDP HDI is the most currently index quoted by poverty-related literature. As well known HDI summarises (as a composite index) the "achievements" in a specific area (country) according to three "basic dimensions": healthy life, education and living standard.
In order to measure the "achievements", goalposts have been established.

For computing the relative achievement the following indicators and weight are used:

basic dimension	indicator(s)	weight	goalpost max	goalpost min
healthy life	life expectancy at birth (years)	1	85	25
education	adult literacy rate (%)	2/3	100	0
	gross enrolment ratio (%)	1/3	100	0
living standard	GDP per capita (PPP US$)	1	40,000	100

Once established the performances (indices) of each dimension, the composite HDI is computed simply averaging them: HDI : (healthy life index + education index + living standard index) / 3.

It is evident that the HDI is an easy indicator for a comparison at country level and for a rough monitoring their trends.
For instance the values and the trends of the SEA countries have been according to UNDP's HDI as follows:

HDI rank 2003		1975	1980	1985	1990	1995	2000	2003
61	Malaysia	0.615	0.659	0.695	0.721	0.76	0.79	0.796
73	Thailand	0.614	0.652	0.678	0.714	0.749	..	0.778
108	Viet Nam	..	..	..	0.617	0.66	0.695	0.704
129	Myanmar	..	..	..	..	..	..	0.578
130	Cambodia	..	..	..	..	0.533	0.541	0.571
133	Lao	..	..	0.423	0.45	0.487	0.522	0.545
85	China	0.525	0.558	0.594	0.627	0.683	..	0.755

The distance in the most recent available year (2003) between Malaysia-Thailand and the block Myanmar-Cambodia-Laos is evident (worth to be noted the intermediate position of Viet Nam).

However to possibility of using the HDI at sub-country level for the SEA countries seems-at least at the time being – very far. Problems, in particular, arise from the lack of GDP figures at sub-national level. The Sach approach, to whom the Global Natural Disaster Risk Hotspots Project make reference, seems scarcely promising when working with tabular and not raster data).

While the UNDP's HDI is a easy tool for measuring country "average" achievements, an other UNDP index, the HPI-1, could offer more useful – at least conceptually – suggestion for a SEA poverty-HSPs analysis.
The Human Poverty Index-1 measures "Deprivations" in three basic dimensions already taken into captured by the above HDI. (note: HPI-1 is used for developing countries, while HPI-2 is for selected OECD countries, in this case a forth deprivation dimension, "social exclusion", is included).

The basic three deprivation dimensions are: healthy life-vulnerability, knowledge-exclusion, a decent standard of living. Worth to be noted that the HDI approach uses concept more familiar to the dictionary of the poverty literature than the HDI approach..

The indicators used for computing the three components of the deprivation are already indicators normalised (because already expressed in percentage): consequently the HPI has the advantage of not-to-be affected by the decision of defining a-priori goalposts as for HDI.

The knowledge exclusion is measured:
by the adult illiteracy rate (%)
The healthy life-vulnerability:
by the probability at birth of not surviving to age 40 (time 100)
While deprivation in a decent standard of living
by an unweighted average of two indicators, namely:
population without sustainable access to an improved water source (%) and
children under weight per age (%)

The formula for calculating the HPI-1 is as follows:

HPI-1 = $[1/3 (\text{Indicator1}^{\alpha} + \text{Indicator2}^{\alpha} + \text{Indicator3}^{\alpha})]^{1/\alpha}$
where, in Human Development Report (2004), $\alpha = 3$ for not giving overwhelming weight to areas of more acute deprivation.

The result here below for the SEA countries confirm a similar ranking when compared with the HDI, in spite of the smooth different position of Cambodia and Lao.

		Population below Income poverty line (MDG) %			
	HPI-1 2003	$ 1 a day	$ 2 a day	National Poverty line 1990-2002	HDI rank 2003
Malaysia	**8.9**	<2	9.3	15.5	61
Thailand	**12.8**	<2	32.5	13.1	73
Viet Nam	**21.2**	..	..	50.9	108
Myanmar	**21.9**	..	..	..	129
Cambodia	**41.3**	34.1	77.7	36.1	130
Laos	**38.2**	26.3	73.2	38.6	133
China	12.3	16.6	46.7	4.6	85

In the case of SEA countries (Yunnan excluded), considering the current data availability, a sub-national level HDI-1 full computation is hampered by the lack of information on the probability at birth of not surviving to age 40.