The Study on Benchmark and Indicators for Desertification Monitoring and Assessment in Asia Region

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Abstract:

Benchmark and Indicators is the technical foundation of desertification monitoring and assessment. Desertification is a global environmental problem and combating desertification requires not only universal serious-minded attentions but also acceptable, available and effective tools and methods. Benchmark and Indicators is developed and set up in order to reveal the intrinsic characteristics of desertification and the regular patterns of desertification occurrence and development. Based on such Benchmark and Indicators a series of methodologies and standards for desertification monitoring and assessment can be developed and the results can enable informed decision-making for combating desertification with guidance of **UNCCD** to alleviate the negative effects of desertification and raise of public awareness on desertification and its effects. The existing Benchmark and Indicators system may not be sufficient or suitable for desertification monitoring and assessment at regional level. Improving and standardizing the Benchmark and Indicators system can firstly contribute preparation of desertification mapping. It is essential to work out a common set of benchmarks and indicators that is widely accepted by the region, and eventually by the world.

The Benchmark and Indicators proposals have been received from most of the TPN1 member countries so the proposal has been firstly revised to reflect part of the comments and suggestion.

Key Words: Land degradation, **desertification**, **benchmark and indicator**

1、 Introduction

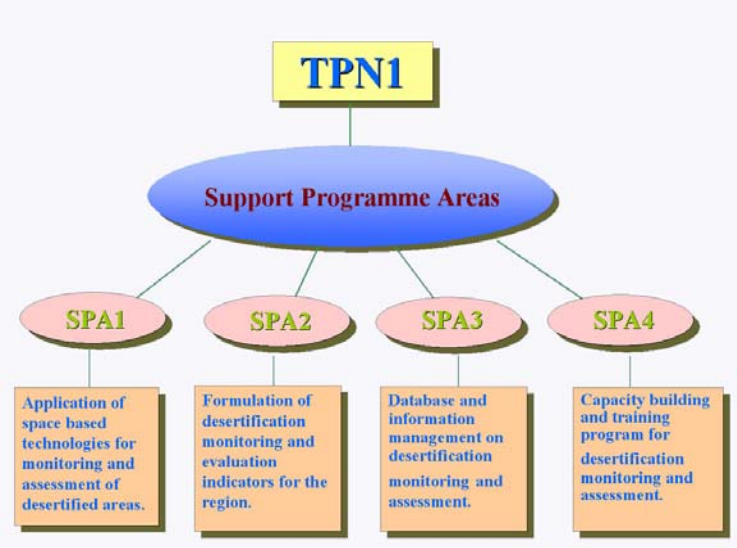
Desertification is definition by the United Nations Convention to Combat Desertification as “land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climate variation and human activities”. It has threatened the human economy development and social stability directly, and it has become the most arresting serious environmental problem in the world. Have been evaluated the global desertification status three times by **UNEP**, according to the investigation, Africa and Asia are the most serious areas in soil desertification.

The lost productivity through desertification in Asia is ranked as the worst among the regions in the world. More than 50 percent of the world’s irrigated lands affected by water logging and salination are also found in Asia.

2、Benchmark and Indicators for Desertification Monitoring and Assessment

At present, investigating the desertification distribution and the dynamic change tendency is becoming the topic to attract more and more scholars and scientists gradually. The assessment is ideally based on identification of appropriate physical, biological and socio-economic indicators. The result will affect the veracity of the scientific evaluation for desertification distribution scope, the harm degree and the preventing and controlling benefit directly.

Guided by the provisions of the **UNCCD**, The Asian Regional Thematic Programme Network on Desertification Monitoring and Assessment, abbreviated as TPN1, was launched in July 1999 in Beijing, China. China has been identified as the host country to coordinate TPN1 activities among the member countries.



The Task Group Meeting on Benchmarks and Indicators for Desertification Monitoring and Assessment under the TPN1 was held in Beijing. A proposed common set of benchmarks and indicators has been agreed upon at the meeting for comments, suggestions and further development.

The **indicator system** includes four aspects: **pressure**, **state, desertification impact and implementation**.

Pressure indicators characterize driving forces both natural and man-made, affecting the status of natural resources and leading to desertification. The principal natural factors include climate, physiognomy and nature disaster. The principal man-made factors include social economic activity.

Desertification is the resultant consequences of natural and human factors. Physical geographic conditions and climate varation are some of the indispensable factors causing desertification with a slow developmental process.However,human economic activities stipulate and accelerate the processes of desertification as main causes.Unceasing population growth has caused population pressure and irrational land use has brought about the wide spread of land desertification. [1]

West Asia is a typical area that desertification degree of hazard highest areas. West Asia has a special and unusual climate, this is the so-called "Mediterranean"climate.Wind erosion,water erosion, Soil salinization ,large population and backward productivity has accelerated the desertification. South Asia has a much higher population density, creating severe land pressures. Intensively over-grazing, marginal cultivation, and sand dunes, which have a high rate of movement, expanded the desertification. Also as the result of the 20th century 50's over exploitation**,** Central Asia face drought and desertification risk on a wide scale, and have been affected 4,000,000 square kilometer lands. [2]

Pressure indicators will be used to assess desertification trends and for early warning.

State indicators characterize the status of natural resources including land. Namely it indicated the degree of the land degeneration, it can be consisted of three parts: Physical indicators, chemistry indicators and biological indicators**.** These are the main factors to characterize the characteristic of the terrestrial ecosystem.

In Asia region, the physical indicators characterize the status of soil erosion, sand dune activity, bare area, surface water and groundwater etc. The chemistry indicators characterize the status of soil salinization, alkali land etc. The biological indicators characterize the types and the community of vegetation, the composing of plant species and animals, the vegetation biomass, and the plant productivity etc.

Desertification impact indicators will be used to evaluate the effects of desertification on human beings and environment. Desertification impact indicators include socioeconomic indicators and environmental indicators. With increasing resource use pressure, desertification leads to increased poverty; many people have to face deteriorating living conditions. About 35% of the useful land in Asia has been influenced by desertification. Due to decline of natural vegetation and unsustainable agriculture, the capacity of soil and water resources to support life has been reduced.

Implementation indicators will be used to assess the actions taken for combating desertification and to assess its impacts on natural resources and human beings. Such impacts that include actions and effects will refer to improvements of socio-economic and natural conditions.

The International Symposium on Space Technology Applications for Sustainable Dry land Development and Desertification Monitoring was held in Oct. 22-24, 2003, Beijing. This Symposium contained the session for reviewed and discussed Benchmark and Indicators Development and mapping for Desertification monitoring and Assessment Participants appreciated the draft proposal developed by Expert Group and suggested to include more issues in the draft proposals:

Mass Movement (Landslide/mud-rock flow): These issues should be stressed as one of the main elements for desertification monitoring. The process of mass movement is very common in hilly, terrains of cold desert in India, China and other countries.

Over-grazing: is another factor that causes mountain ecosystem degradation and it should be concerned as one of desertification impact indicator to assess the urgency of the issue, particularly in steppe zone and mountain areas. Central Asia countries face this issue since 1960s' and its development trend is accelerating in high annual rate. Range degradation is a prevailing process in central Asian countries.

Soil erosion and Salinization: are the common phenomena in Kuwait, Yemen, Thailand and Vietnam. Under the drought impact and miss-management of water resources in Southeast Asian countries, almost ASEAN countries face serious development of soil salinization and promotion of soil erosion.

Deforestation and vegetation degradation: Deforestation, soil erosion and vegetation degradation are prevailing natural hazards in Southeast Asia and Pacific island countries. **Drought and aridity:** drought and aridity are the two key factors cause land degradation and desertification in most Asian countries, like Yemen, Kuwait, Myanmar, Cambodia, Laos and Vietnam etc. The drought and aridity issues were requested to include as elements of indicators to monitoring desertification and mapping.

.**Soil parameter**, like soil texture, soil depth and soil moisture should be regarded as one of the components of the indicator system. Soil definition and classification are different in various countries. It was suggested to consider the necessity of adoption of global classification system. **[3]**According to desertification definition of United Nations Convention to Combat Desertification and the features of desertification in Asia region.

"Benchmarks" are the baselines that serve as the starting point for evaluation and monitoring and thus provide a point of reference from which the land starts to degrade or improve.

"Benchmarks" are used to develop correlations between various parameters and to provide a baseline for monitoring at the local, national and regional levels.

"Benchmarks" are standards against which decertified land can be compared in order to determine degradation trends. The benchmarks are also used to quantify the severity/degree of degradation. Different benchmarks are to be established for different agro climatic regions and different land uses. **[5]**

3、Asian Regional Desertification status classification

The desertification benchmarks and indicator system was raised during the symposium of TPN1. This is the basic work for Asian region desertification remote sensing monitoring and assessment in a large area and a large scale.

The classification of desertification status in Asia region follows the principles:

1. Take the indicators of desertification status, pressure, impact, and prevention Implementation as the basis, that fully incarnate the distribution characters, the rule and the degree of the desertification land, to reflect the status of the Land resources and land use (Land resources character, specialty and the land use pattern) in Asia region factually.

2. In order to ensure the criterion of the achievable precision in anticipated level by using the remote sensing classification investigation technology, Any land type which under the required level of precision and unable to achieve the expected level of precision will not be separately included in the classification system.

3. The result of the classification should adapt the demand of the remote sensing resource investigation in wide range.

Table 1 The Asian Regional Desertification status classification

Type	The characteristics
Forest	The arbor forestland, shrubs, or bamboos grow (with shade density >10%) and other forestry sites.
Meadow	Referring to all kinds of Meadow: with above 5% of vegetation coverage where mainly herbaceous plants grow, the shrub grassland mainly for grazing with a shade density of below 10%.
Farmland	The cultivating land where planting the crops
Urban	Building, Factory, inhabitation, Communication lines
Water	Lake, reservoir, Rivers and canals
Un-using land	Desertification land (Severe, Medium and Slight), Gobi deserts, snow-covered land and ice fields.

To classify desertification degree, according to two indicators:(the coverage of vegetation and the land surface status of the quicksand)

Table 2 The Asian Regional Desertification degree classification

Type	**The characteristics**
Severe Desertification	The vegetation is scarce and short, basically without vegetative cover, or coverage of vegetation ＜10%. Big areas of concentrated the quicksand hills are present. The area of quicksand occupied about 50% of the land.
Medium Desertification	The coverage of stable perennial vegetation cover degree is about 10%～20%. The surface of the land has been seriously damaged by wind erosion; the shrub-coppice dunes and big areas of quicksand were appeared. The area of quicksand occupied about 30%-50% of the land.
Slight Desertification	Semi-sand and semi-grass, the coverage of vegetation is about 20%～40%.The surface of the land has been partially damaged by wind erosion and small plot of quicksand was appeared. The area of quicksand occupied about 10-30% of the land.

4、Conclusion

The land desertification assessment is an important theory in the research of desertification. Desertification is the degradation of ecosystem on the surface of the earth. It is a science in which natural and social science overlap and interact with each other.

Not only the desertification is a process of the land degeneration, moreover also is the result of the land degeneration.（**Mainguet, 1994**）

The study on Benchmark and Indicators for Desertification Monitoring and Assessment have been started in the 20th century for 70's, Desertification assessment requires arguments built upon diverse indicators. The integrate Benchmark and Indicators system for desertification monitoring and assessment will make it possible to assess various policy options objectively, which will enable the formulation of proposals for the most appropriate and feasible land-use methods, there will be a great progress for large-scale assessment of desertification in arid and vulnerability distribution regions of Asia.

Benchmarks and indicators for local land vulnerability assessment can be proposed for application in fieldwork, which could contribute to the establishment of a technique to diagnose the level of land degradation. Such benchmarks and indicators, usable for on-site diagnosis, are an international desideratum, and can be expected to be both highly useful and highly functional. **[9]**

The scientific importance of the Benchmark and Indicators for Desertification Monitoring and Assessment has decided the accuracy and the applied value of the result. The Systematic, the accurate, and the feasible of the Benchmark and Indicators are the essential standard for desertification monitoring and assessment.

Assessments based on combination of these indicators have been found effective for drought, but they are not sufficient to provide an accurate assessment for the whole desertification process. It is imperative to develop a scientific statistical method and the evaluation criteria to consummate the standard of the Benchmark and Indicators system for desertification monitoring and assessment.

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