



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Technical guidelines for identification and assessment of
environmental damage - Ecosystem - Part 1: Farmland
ecosystem**

生态环境损害鉴定评估技术指南 生态系统 第1部分：农田生态系统

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3 Terms and definitions

Farmland is defined as land that can be used to grow crops, namely class 01 cultivated land of GB/T 21010, comprising paddy field, irrigated land and dry land.

A farmland ecosystem is defined as the complex in which human beings, in farmland centred on crops, use the relations between the biological and the non-biological environment and between biological populations to carry out energy conversion and material circulation through ecological structure and ecological function, and to produce material according to the needs of human society.

Damage to a farmland ecosystem is defined as the adverse change, caused by polluting the environment or destroying the ecology, of the environmental elements such as farmland soil, farmland irrigation water and the atmosphere of the farming area and of the biological elements such as the crops, together with the degradation of function and reduction of services of the farmland ecosystem those elements compose.

The farmland ecosystem service function is defined as the service to human beings rendered by the material produced by the farmland ecosystem and by the natural and man-made environment that material forms, and comprises provisioning services, supporting services, regulating services and cultural services.

4 Work procedure

The work procedure comprises the preparation of the programme, the survey and confirmation of the damage, the causal analysis, the physical quantification of the damage and the preparation of the restoration plan, the value quantification of the damage, the assessment of the effect of restoration and the preparation of the report; it is shown in Figure 1.

At the programme stage the basic situation and main features of the damage are established and, by collecting background material on the farmland soil and the crops grown in the region, the content, extent and methods of the identification and assessment are settled and the programme drawn up.

The survey stage has two parts, the exclusionary survey and the environmental damage survey. The exclusionary survey comes first and rules out cases in which the damage is caused only by climate change, natural disaster or a high background value. The damage survey that follows covers the basic condition of the farmland soil, the farmland irrigation water and the crops grown together with the types of ecosystem service, establishes the baseline level and judges the state of damage to the soil, the irrigation water, the crops and the ecosystem service functions.

At the causal analysis stage a judgement is made on the causal relation between the act of destroying the ecology or polluting the environment and the damage to the farmland ecosystem. At the physical quantification stage the assessment indicators are screened and settled, their present level is compared with the baseline level, the degree and the spatial and temporal extent of the damage are settled and the physical quantity computed; the damaged ecosystem is then rated for recoverability, and where it can be recovered the restoration target is made clear, a basic restoration plan drawn up, the interim damage computed and a compensatory restoration plan drawn up.

At the value quantification stage, for a recoverable ecosystem the resource and environmental value during the restoration period is to be included in the amount of damage besides the restoration cost, and for an unrecoverable ecosystem the amount is computed by the resource and environmental value quantification method. At the assessment stage the recovery of the ecosystem is monitored periodically and the consistency of the effect with the expected target is assessed as a whole, supplementary restoration being carried out where the target has not been reached. At the report stage the identification and assessment report and the restoration effect assessment report are prepared and a work file established as required.

6 Survey and confirmation of farmland ecosystem damage

6.1 The exclusionary survey follows NY/T 3665 and consists chiefly in a first analysis of the

fact of damage and in identifying its cause; where the object is damaged only by climate change, natural disaster or a high background value, the survey stops and an investigation report is prepared, and otherwise the damage survey proceeds.

6.2.1 and 6.2.2 The indicators to be surveyed, monitored and assessed are chosen according to the type and features of the damage, with reference to Annex A. Where the damage comes from destroying the ecology, the basic information on the mode, extent and distribution of the destruction is collected, and the start and end time, the frequency and intensity and the area destroyed are surveyed, together with the evidence of the damage caused. Physical soil damage such as compaction, hardening, excavation, subsidence and artificial barrier layers is surveyed following NY/T 4155. Damage by harmful organisms requires the survey of their source, species, number, frequency of invasion, pattern and mode of occurrence and spread, and range of activity, alien species following HJ 624. Damage by over-abstraction of groundwater requires the survey of the groundwater level, the abstraction volume and the groundwater points. Damage by soil erosion requires the survey of the cause, type, duration and distribution of the erosion and the monitoring of slope, soil erosion modulus, crop cover, water and soil conservation measures, the type and area of destruction, the erosion gullies of the farmland and the production roads and gravity erosion, which may follow GB 50433, GB/T 51240 and SL 190. Damage by desertification requires the survey of crop cover, the erosion gullies of the farmland and production roads, and the area of sandy land, wind-eroded land or moving sand. Damage by salinization requires the survey of the distribution and degree or level of the salinization, the groundwater level and flow direction, the irrigation level and the several indicators of the irrigation water related to salinization. Where the damage comes from polluting the environment, the pollution source, the pollutants and the pathways are surveyed following NY/T 3665.

6.2.3 The objects of the damage survey are the farmland soil, the farmland irrigation water, the crops and the ecosystem service functions. Soil damage is surveyed from remote sensing imagery, relief and cadastral material together with field investigation, the indicators being chosen by the assessor from the real situation with reference to Annex A, and sampling, monitoring items, the settling of the analytical method and the laboratory analysis following NY/T 395. Irrigation water damage is surveyed from remote sensing imagery, hydrological and water quality material and the distribution of the water system together with field investigation, and where necessary the history of sewage irrigation is surveyed from historical material; the indicators follow GB 5084 and Annex A, and sampling, monitoring items, the settling of the analytical method and the laboratory analysis follow NY/T 396. Crop damage is surveyed following SF/Z JD0606002, the indicators following that document and Annex A, and sampling, monitoring items, the settling of the analytical method and the laboratory analysis following NY/T 398. Ecosystem service functions are surveyed by material collection, field survey, expert consultation, monitoring and sampling and laboratory testing according to the type of function damaged, so that the historical and

present information on the farmland ecosystem of the assessment area is obtained and the main service functions before and during the damage are made clear; those functions chiefly comprise agricultural product supply, soil conservation, biodiversity maintenance and water conservation, biodiversity matters following the relevant national and industry standards on biodiversity observation, and genetic resources and cultural services following Annexes A and B. The restoration and pollution removal measures already carried out and their cost are also surveyed, together with the state of damage and the recoverability of any area where alternative restoration might be carried out.

6.3 Quality control requires that the survey be systematic, complete and objective and be fully recorded following GB/T 39791.2, the record being signed by the surveyor, the recorder and the witness; that the collection, preservation, transfer and analysis of soil samples meet NY/T 395, of water samples NY/T 396 and of agricultural products NY/T 398; that a list of the identification materials be made and signed by the transferring and the receiving party; and that 5 % to 10 % of the collected material be checked at random, and 5 % to 10 % of the information obtained by interview and by survey or record forms be checked at random by revisit, the damage survey being carried out again where the check reveals discrepancies.

6.4 The baseline level is confirmed in a fixed order: from comparison data unaffected by the act, taken from a similar and relatively undamaged area near the assessment area and representative in time and space; from historical data unaffected by the act, taken from figures published by government bodies before the damage or from published research, representative in time and space and obtained at a time such that no factor markedly changing the state of the farmland ecosystem intervened before the act, historical data being preferred where the time of acquisition is close to the time of the damage; from a relevant standard or threshold such as GB 5084 or GB 15618, according to the mode of use and the service function of the farmland; from an expert opinion where none of these is available, the experts being relevant to the case, generally not fewer than five and an odd number, drawn from research institutes and front-line technical staff, the majority opinion deciding where no consensus can be reached; and, where none of the above serves, by special research or simulation experiment. The baseline is expressed chiefly by the area, thickness, volume and physical and chemical indices of the farmland soil before the damage, by the quality of the irrigation water, by the yield and quality of the crops and by the state of the ecosystem service functions, the specific indicators being settled by the assessor; for an ecosystem providing chiefly provisioning services the baseline covers the yield and quality of the agricultural products, for one providing chiefly supporting and regulating services the amount of soil and fertility retained and the amount of water conserved, and for one providing chiefly cultural services the number of visitors and the level of visiting.

6.4.2 Damage is confirmed by comparing the present state of the farmland soil, the irrigation water, the atmosphere of the farming area, the crops and the features and service