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Foreign Experiences in The Management of Regional Ecosystems and Prospects of Their Adaptation to The Adir Areas of Andijan Region

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Abstract: This in the article area ecosystems management according to developed countries experiences comparative analysis made, they Andijan region (Uzbekistan) of the regions natural - ecological and social - economic to the conditions adaptation prospects scientific Based on the research. comparative and systematic analysis, scientific generalization, cartographic approach and field observations from methods used. Field observations as a result hill in the regions ephemeral of plants slope exposition and anthropogenic loading under the influence spread features determined and of the area main ecological problems evaluated. Foreign experiences Netherlands, Australia, USA, Canada and China in the example of water resources management, pastures use, erosion against events, digital ecological monitoring and ecosystems restoration directions according to analysis The research was conducted as a result, Andijan province hill in the regions area ecosystems to manage improvement five priority direction scientific was based on. Proposal done approaches natural from resources stable use efficiency increase, ecological degradation reduce and of the regions climate to change flexibility to strengthen service does.

Keywords: Area Ecosystems, Ecosystems Management, Hill Territories, Abroad Experience, Ecosystems Adapt, Stable Development, Environmental Monitoring, Geographical Information Systems (GIS), Oil Waters Management, Soil Erosion

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1. Introduction

The last one in years global climate change, earth resources degradation, water shortage and biodiversity - diversity contraction area ecosystems management scientific and practical approaches improvement requirement [1]. This factors, especially drought and half dry white in the regions natural from resources stable use, degradation encountered lands restoration and ecosystem services save stay with related problems further is intensifying. This because ecosystems scientific basically management United Nations Organization Stable development goals and land degradation prevent to take according to international strategies priority from directions one as confession [2].

World in practice Netherlands, Australia, USA, Canada and China such as in the countries area ecosystems management according to effective approaches formed. This in countries integrated water resources management, micro-basin on the principle based planning, adaptive pasture management, geographical information systems (GIS) and remotely probing from technologies use, as well as erosion against complex events done

increase as a result natural from resources use efficiency and ecosystems ecological stability noticeable at the level increased [3].

However this experiments other to the regions straight away implementation to grow every always expected the result Because every one of the area natural-geographical, ecological, climatic and socio-economic conditions to oneself typical to the features has. Therefore, progressive abroad experiences local to the conditions adaptation, their the most effective elements choice and of the area ecological features into account received without application scientific based requires an approach [4].

Andijan province hill areas also have water resources limited, soil erosion, vegetation of the cover degradation and anthropogenic pressure increasing progress with is described. This factors natural from resources use efficiency reducing the area's ecosystems ecological to stability negative impact Showing. Available management practices improvement, ecological risks reduce and of the area natural from the potential reasonable use for international experiments local to the conditions adaptation current scientific and practical task is considered [5].

This of the research the goal is to protect the ecosystems of the area management according to advanced abroad experiences comparative analysis to do and their Andijan province hill of the regions natural-ecological and farm to conduct to the characteristics adaptation prospects scientific from justification consists of [6].

Regional ecosystems management modern scientific approaches. Last ten the ecosystems of the region over the years in management separately natural resources to manage based traditional from approaches ecological, economic and social factors mutual harmonizing integrated management to systems transition trend is observed [7]. This global climate change change, earth degradation, biodiversity contraction and water to resources anthropogenic pressure increase with is interpreted. As a result ecosystems in management of the area ecological integrity storage, resources reasonable use and stable development provide priority to the task became.

Regional ecosystems management the most important scientific from concepts one to the ecosystem based management [8]. This approach natural resources separately object as not, maybe each other of a single ecosystem connected structural parts as to manage in mind Within the framework of the CPA management decisions ecosystem functions, biodiversity, landscape structure and ecosystem of services each other dependence into account received without acceptance Such approach natural from resources far term and stable use opportunity creates.

Last in years integrated ecosystems The concept of Integrated Ecosystem Management (IEM) is also widely is being used [9]. This approach state management bodies, scientific institutions, local population and from resources users between cooperation to strengthen focused on. IEM model territorial planning, environmental monitoring, natural resources management and economic development processes into a single system combine through management efficiency to increase service does.

Ecosystems in management adaptive management separately scientific and practical importance profession [10]. This to the approach according to, management decisions continuous monitoring results based on regular accordingly improving this is especially true in the climate change impact strong was arid and half arid in the regions ecological risks reduce and management flexibility in increasing important tool is considered.

Regional management in practice landscape Landscape Approach is also widely is used [11]. This approach land resources, water objects, forests, pastures and village farm single territorial system as to evaluate is based on. In this ecological protection, food safety, economic development and local population interests between balance the main goal is to provide as is considered.

Above seeing issued scientific approaches various natural-climate and institutional under the circumstances formed although, their general purpose ecosystems ecological stability provide and natural from resources effective use on the road from putting consists of. With this together, them certain in the area in use local natural-geographical, ecological and socio-economic features into account to take important is considered. Therefore Andijan province hill regions for foreign scientific approaches complete relocation not, maybe their effective elements local to the conditions adaptation scientific and practical in terms of the most acceptable solution is considered [12].

Regional ecosystems management according to abroad of experiences comparative Analysis of the area's ecosystems management according to international experience this shows that management systems efficiency natural-climate conditions, institutional management model, resources use culture and modern technologies application to the level directly related. Different in countries working issued approaches content in terms of Although they differ, their main purpose natural from resources stable use, ecosystems ecological stability storage and anthropogenic pressure to reduce focused [13].

The Netherlands' regional ecosystems in management integrated water resources management model with in the world leader from countries one is [14]. In the country water Basins Water Boards system through controlled, from water use, lands planning and single institutional environmental monitoring mechanism based on done This is approach water from resources use efficiency increase with one in a row, water with related ecological risks also serves to reduce does.

Australia experience dry and white and half arid in the regions adaptive pasture management principles [15]. The pastures ecological capacity Regular monitoring is carried out, livestock load natural to opportunities suitable accordingly order is inserted and to degradation encountered lands restoration according to complex programs done This is approach natural plant cover storage and desertification processes in restriction high efficiency manifestation reached.

Regional ecosystems in the United States in management watershed principle priority place occupies. In this management main unit administrative borders not, maybe natural water assembly basins is [16]. This approach soil erosion reduce, superficial the flow order to plant and water quality improve opportunity giving, especially slope in the regions high ecological and economic efficiency provides.

Canada ecological monitoring digitization according to advanced to experience has from countries Geographical information systems (GIS), remotely probing data, drone technologies and digital cartography tools using land resources, plant cover and degradation processes regular following [17]. As a result management decisions fast and scientific based to the information relied on without acceptance will be done.

The Loess Plateau area of China done increased ecosystems regional recovery program management according to the most successful from projects one as confession Terracing, contoured farming, afforestation and local population active to participate

based complex approach as a result soil erosion noticeable reduced, plant cover restored and village farm productivity increased [18].

This countries of experience comparative analysis this shows that their the only technology that can succeed or management to the method not, maybe scientific planning, continuous monitoring, stakeholders sides cooperation and adaptive management principles to the harmony is based on. With this together, every a model of its own of the country natural and institutional to the conditions suitable accordingly formed. So, foreign experiences Andijan province hill to the regions implementation in the process of them complete relocation not, maybe local natural-geographical, ecological and socio-economic to the features adaptation to the goal is appropriate.

Abroad in countries used management approaches, their main means, achieved results and Andijan province hill regions for adaptation the possibilities are listed in Table 1, accordingly cited.

Table 1. Regional ecosystems management according to abroad of experiences comparative description and Andijan province hill to the regions adaptation opportunities

Country	Home management approach	Applicable tools	Achieved results	Andijan hill regions for suitable aspects	In use restrictions
Netherl ands	Integrated water resources management	Water councils, hydrotechnical facilities, water monitoring	Water use efficiency increased	Rain water collection and basin full-year based on management	Water resources and economic opportunities difference because of complete implementation to grow limited
Australi a	Dry white lands and pastures adaptive other-view	Pasture livestock, cattle download standardization	Pasture degradation decreased	From the pastures in moderation use and degradation restriction	From the pastures use knee -mini step by step reform to do necessary
USA	Microbasin management	Basin planning, erosion against events	Soil erosion and water flow controlaging	Hill territories micro-ponds in the section management	More details cartographic and hydrological information is required
Canada	Digital environmental monitoring	GAT, remote sensing, drone technologies	Quick monitoring and forecast	Digital monitoring system current to grow	Modern technology and qualified experts necessary
China	Ecosystems complex restoration	Terracing, afforestation,	Soil and plant cover -is it restored	To erosion against complex	Local relief and taking into account econo-

contouring farming	reclamation works	mic oppor- tunities received step by step done increase neces- sary
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Table 1 data this analysis shows that made regional ecosystems in countries management success natural from resources use scientific planning, modern monitoring technologies apply, interested sides cooperation develop and adaptive management principles consistent done increase with related. Management mechanisms shape various although, their all ecosystems ecological stability provide and natural from resources reasonable to use service does.

Comparative analysis results this shows that foreign experiences Andijan province hill to the regions complete relocation to the goal appropriate not. Their effective elements of the area natural-geographical, ecological and socio-economic features into account received without adaptation high result to give possible. Therefore next in the department this experiments Andijan province hill to the regions adaptation scientific basics and priority directions in detail is illuminated.

Abroad experiences Andijan province hill regions ecosystems to manage adaptation prospects. Abroad countries of experience comparative analysis this showed that the ecosystems of the area management effective models natural-geographical and institutional conditions into account received without formed. Therefore this experiments Andijan province hill to the regions complete relocation not, maybe their scientific and practical in terms of effective elements local to the conditions adaptation to the goal appropriate is considered.

Andijan of the province hill regions sea from the surface relatively height, slope relief, fat reduction uneven distribution, seasonal water shortage and soil erosion tendency with is described. Also, livestock farming of the load increase, natural plant of the cover degradation and anthropogenic of influence increase ecosystems ecological to the stability negative impact showing. Therefore management system ecological, economic and social a single system of factors as cover to receive necessary.

Research results based on Andijan province hill regions for following five priority direction recommendation is being done:

First, the micro-basin on the principle based territorial planning current to do. In this water currents, relief features and erosion danger into account taken, management measures natural water assembly basins in the section working exit necessary.

Secondly, it rains. waters collection and from them effective use system development [19]. Small voluminous water warehouses, water collect reservoirs and water saver irrigation technologies application through vegetation during water supply stability increase possible.

Third, digital environmental monitoring system formation. Geographical information systems (GIS), remotely probing data, drone flight devices and remote observation tools based on land resources, plant cover, soil erosion and degradation processes regular monitoring management of decisions scientific based on increases.

Fourth, degradation encountered regions complex reclamation to do. In this to erosion against agrotechnician events, contoured processing to give, to protect the forests

build to grow and local to the conditions suitable many annual plants planting important importance has.

Fifth, local population, farmer farms, scientific institutions and state organizations between to cooperation based adaptive management system develop ecosystems in management interested of the parties active participation management efficiency and far term stability provides.

Offer done priority directions abroad of experiences effective elements Andijan province hill of the regions natural-ecological and farm to conduct to the characteristics adaptation opportunity gives and the ecosystems of the region ecological stability strengthening, natural from resources use efficiency increase and climate to change flexibility to strengthen service does (Table 2).

Table 2. Abroad experiences Andijan province hill to the regions adaptation priority directions

Abroad experience	Andijan hill regions for customizable element	Expected result
Netherlands - integration water management	Rain waters collection, reservoirs organization to grow	Water from resources benefit efficiency increases
Australia - grasslands adaptive management	Cattle download standardize, exchange use	Pasture degradation decreases, plant cover will be restored,
USA - micro-basin principle	Water assembly basins in the section planning	Erosion and superficial stream decreases
Canada - digital monitoring	GAT, remotely probe and from drones use	Monitoring accuracy and management quality increases
China - to erosion against complex events	Contoured farming, terracing and recultivation	Soil erosion decreases, biodiversity will be restored

Table 2 data this shows that foreign in countries ecosystems of the area used management approaches effective elements Andijan province hill of the regions natural-geographical and socio-economic to the conditions when adapted their practical efficiency noticeable at the level increase possible. Especially, micro-basin on the principle based planning, precipitation waters collection and from them reasonable use, digital environmental monitoring and to erosion against complex events current of the area's ecosystems ecological stability in providing important importance profession will reach.

Also, comparative analysis results abroad experiences complete relocation not, maybe to their local conditions suitable coming elements local management to the system integration to do the most acceptable approach that shows. This is natural from resources use efficiency increase, degradation processes restriction and hill of the regions climate to change flexibility to strengthen service does.

2. Materials and Method

Research object as Andijan of the province hill regions selected. Research territory of the province Andijan, Asaka , Bulaqbashi, Bo'z, Izboskan, Jalalquduk, Marhamat, Khojaabad and Kurgan-tepa in the districts located hill landscapes cover takes. This of the regions general area 44,034.6 hectares organization reach, slope relief, fat reduction uneven distribution, seasonal water shortage, soil erosion and anthropogenic pressure height with

this is described. characteristics of the area's ecosystems in management scientific based and complex approaches application necessity to the surface brings.

The research information base international scientific literature, UN Food and village farm Organization (FAO), Desertification against fight UN Convention on the Elimination of All Forms of Cruelty to Animals (UNCCD), International nature protection to do Union (IUCN) and other international organizations reports, as well as Uzbekistan Republic regulatory and legal documents and Andijan province according to there is statistic and cartographic information organization. From this besides, research during hill in the regions author by take visited field observations results and from visual monitoring data used.

In the study systematic analysis, comparative analysis, scientific generalization, geographical comparison and cartographic analysis from the methods used. Foreign in countries ecosystems of the area being used management experiences content compared, their Andijan province hill to the regions adaptation opportunities evaluated. Geographic information systems (GIS) and remotely probing technologies related scientific sources analysis monitoring of regional ecosystems based on modern approaches generalized.

Research methodology of the area natural-geographical, ecological and socio-economic features complex assessment on the principle is based on. In this foreign experiments local to the conditions adaptation scientific basics working out, their practical application opportunities comparative analysis based on was evaluated.

The research scientific novelty abroad in countries ecosystems of the area being used management effective elements Andijan province hill of the regions natural-ecological and farm to conduct to the conditions adaptation according to practical recommendations system working issued with explained.

3. Results and Discussion

The Research during abroad the territorial ecosystems of their countries management according to experiences Andijan province hill of the regions natural-ecological features with comparative analysis analysis results this showed that the area relief, water resources seasonal distribution, soil erosion tendency and anthropogenic pressure level management system local to the conditions requires adaptation.

Field observations and there is scientific sources analysis based on hill of the regions main ecological problems as soil erosion, natural plant of the cover degradation, precipitation of the waters ineffective flowing departure and from the pastures from the norm more than use cases This was determined. factors ecosystems ecological stability reduce, natural from resources use to the effectiveness negative impact showing.

Comparative analysis results abroad of experiences following elements Andijan province hill regions for the most promising that showed:

- micro-basin on the principle based territorial planning;
- rain waters collection and from them effective use system development;
- geographical information systems (GIS) and remotely probing based on ecological monitoring on the road to put;
- to erosion against agrotechnician and biological events complex application;
- local population and interested organizations to participate based adaptive management mechanism to form.

This research results based on Andijan province hill regions for the area's ecosystems management adaptive model working (Figure 1). This model is used for

monitoring, analysis, management decisions and again to the principle of feedback based to be, to manage process continuous improvement provides.

Model's main advantage is that it is natural and geographical factors, modern monitoring technologies and management mechanisms into a single system This is ecological risks own on time detection, management decisions scientific justification and natural from resources use efficiency increase opportunity gives.

Results this shows that foreign of experiences scientific based elements local to the conditions adaptation Andijan province hill in the regions soil erosion reduce, precipitation from the waters use efficiency increase, degradation encountered lands step by step restoration and ecosystems ecological stability reinforcement for important practical basis become service to do possible.

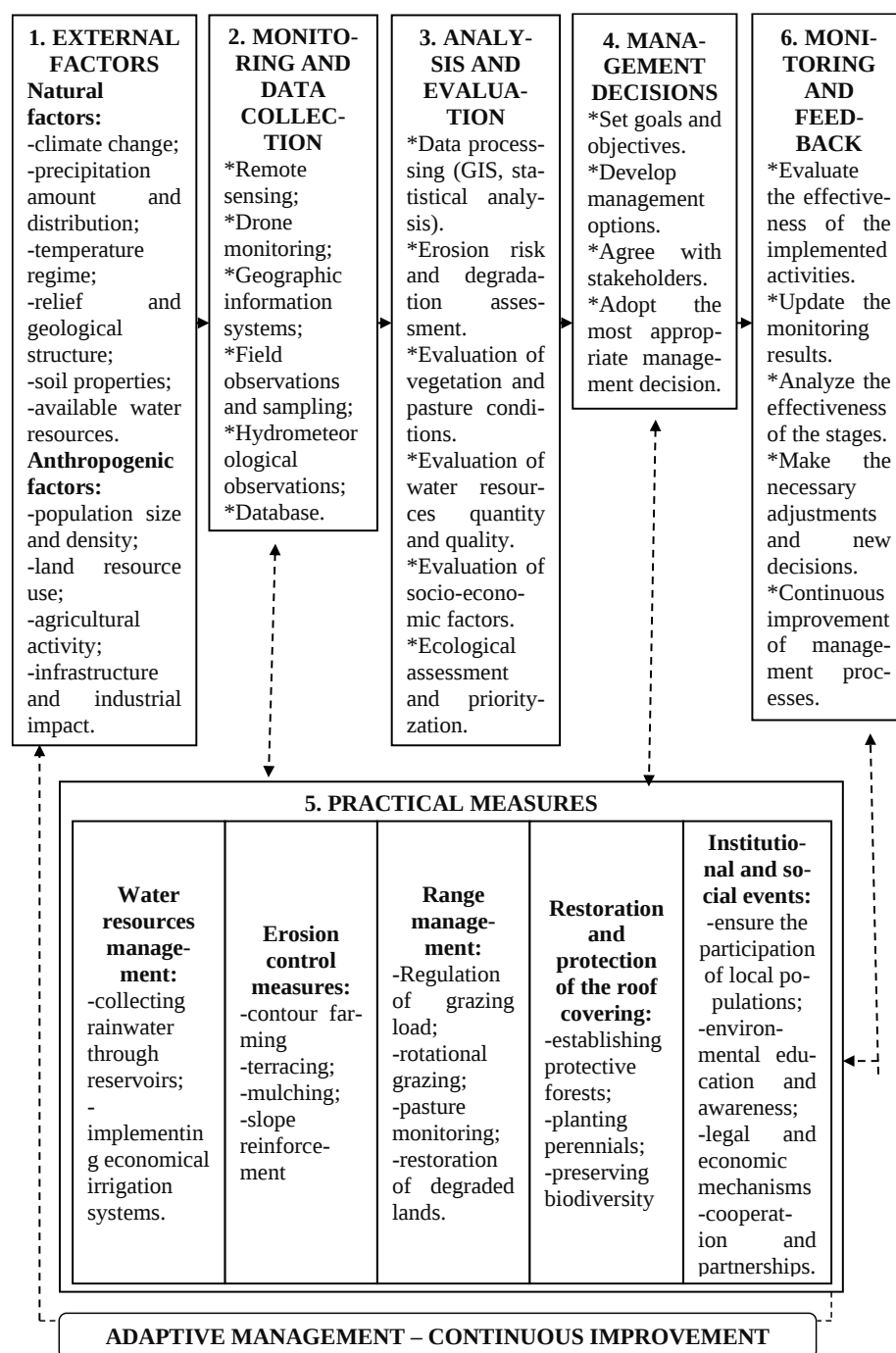


Figure 1. Andijan province hill regions ecosystems management adaptive model

The proposal in Figure 1 done adaptive management model, area ecosystems management continuous and each other related stages reflection Model external natural and anthropogenic factors into account received without ecological monitoring organization to take, taken information complex analysis to do, scientific based management decisions working exit and their practical the results again assessment on the principle is based on.

Model's important aspect is that in it again feedback mechanism in mind this is the management. Measures efficiency regular assessment and monitoring results see them improving to go opportunity gives. This approach climate change, water shortage and anthropogenic pressure intensifying going under the circumstances hill regions ecosystems stable management scientific and practical basis creates.

4. Conclusion

This study demonstrates that effective regional ecosystem management in the hill territories of Andijan Province, Uzbekistan, cannot be achieved through the wholesale transplantation of foreign models but rather demands a scientifically grounded process of adaptive integration whereby the most transferable elements of international practice are calibrated to the specific natural-geographical, ecological, and socioeconomic conditions of the local adir landscape. The findings, derived through comparative analysis of ecosystem management experiences in the Netherlands, Australia, the United States, Canada, and China, reveal that the common determinants of management success across these diverse contexts are integrated planning, continuous ecological monitoring, multi-stakeholder cooperation, and adaptive feedback mechanisms rather than any single technology or intervention, and that each of these principles can be meaningfully applied to Andijan's hill regions through five priority directions: micro-basin-based territorial planning, precipitation water collection and efficient utilization, GIS and remote sensing-based ecological monitoring, complex anti-erosion reclamation measures, and the development of adaptive management systems grounded in the active participation of local communities, agricultural enterprises, scientific institutions, and state bodies. These findings carry substantive implications for land use policy and environmental governance in Uzbekistan, underscoring the urgent need to transition from sector-specific resource management toward an integrated ecosystem-based approach that simultaneously addresses soil erosion, vegetation degradation, water scarcity, and anthropogenic pressure within a unified institutional framework aligned with the UN Sustainable Development Goals and the UNCCD. Future research should conduct longitudinal empirical monitoring of the proposed adaptive management model to quantify its effectiveness under varying climatic and anthropogenic conditions, while comparative studies extending this analytical framework to other hill and semi-arid zones across Central Asia would clarify the regional scalability of adapted foreign experiences and contribute to the development of a broader evidence base for ecosystem governance in climate-vulnerable dryland territories.

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