



Strategy of sustainable protection and management on ecosystem area of karst essential in Trenggalek regency

Bandung Setyobudi, Dewi Gunawati

Faculty of Law Sebelas Maret University, Surakarta, Indonesia

Abstract

Problem identifications of this research are: 1). referring to data of environment and forestry ministry, Trenggalek Regency has had karst ecosystem area width 53.506,67 ha spreading in 13 districts and ecosystem delination width 35.122,77 ha or 66% are recommended with protection function and its width 18.193,90 ha or 34% as instruction functioning as cultivation. The empiric data of width karst ecosystem area show protection function is only 12.137,68 ha or 35% which has been set on spatial area plan (Rencana Tata Ruang Wilayah-RTRW) Trenggalek Regency 2012-2032. 2). Authority limitation of Trenggalek government to manage and take advantage of karst area. Scrutinizing those problems, purpose of this research is to know sustainable management and protection on karst ecosystem in Trenggalek Regency. This research is a doctrinal research which examines related basis, law concept, and regulations. The data which is used in normative research using secondary data which consists of primary legal material and secondary legal material of management and protection of karst ecosystem in Trenggalek Regency including 2 factors, they are: regulation/law policy and institutional harmonization. The strategies which are recommended to overcome the problem of management and protection of karst ecosystem in Trenggalek Regency is by function instruction, management instruction, and taking advantage instruction. Recommendation: on overcoming problem of sectorial organizational ego sustainable protection and management karst ecosystem area so it is urgently formed of communication forum whose function is to overcome problems which appear because of regulation policy and institutional disharmonization so that management and protection of ideal karst ecosystem utilization.

Keywords: sustainable development, regional government, spatial area plan, natural resource of karst

Introduction

The environmental damage is triggered by the natural resources exploitation which is done accumulatively is an urgense problem to be researched. The environmental damage has impact on decreasing of living thing's life quality who inhabit the earth. Statute number 32 of 2009 about protection and management of environment mandates the stakeholders especially to government to truly and consistently strive toward protection and management of environment for ensuring the living thing sustainability and ecosystem sustainability, including karst ecosystem.

The existence of karst ecosystem in some countries has been avowed as area which need attention on its protection. Karst is a unique topography formed as a consequence of water flow on carbonate stone usually in form of lime, dolomite or marble. According to Ford and Williams, karst is an area having landscape and special hydrology pattern which is formed from combination rock properties having high solubility level and well-developed secondary porosity. Generally, karst area has important part consisting of eksokarst (top of karst surface) and endokarst (bottom of karst surface.)

The essential functions of karst ecosystem toward environment are: the place for water storage and water supplier for human life. The top surface of karst area is a possible long time delay for rain water to flow to Underground River. It makes karst ecosystem able to store and flow water to underground water source and river until dry season. Besides, karst ecosystem can also influence the area as an area whose carbon up taking can up take double

amount of carbon from forest.

Due to important function from karst ecosystem, so it needs regulation on managing and taking advantage oriented to environment protection. On Tulungagung ecoregion karst (the eastern) and Gunung Kidul karst ecoregion cluster (the western). The type of ecosystem area is vegetation forest community *pamah* lime stone, lime stone forest *pamah monsun* molt, and lime stone forest *pamah* on karst landscape. Based on important role in economic area, karst ecosystem in Trenggalek Regency has important value categorized in extractive utilized value and non-extractive utilized value. The extractive utilized value are mining and forestry (wood and non-wood) and non-extractive utilized value are utilizing landscape, environment service value, biology service value and social service value.

These are existing condition in Trenggalek:

1. Pollution and environmental damage
 - a. Pollution and environmental damage in karst ecosystem is in form of flooding from water or any fluid runs over stone surface will be absorbed by the pores or hole (*ponor*) inside rock layers under it to the waterproof stone forming underground channel (river). The waterflow comes in underground river system and can caused a sudden flood in other area regardless not raining.
 - b. The sanitation problem in upstream area is not well maintained, influencing any fluid and rain water will come into the underground river system. The rain water can also mix with pollutant, residual insecticide, herbicide, oil (include seepage of fuel from gas station),

coli bacteria (feces), household waste, pollutant fluid from final landfill (TPA) in form of organic or non-organic waste B3.

- c. The pollution of water stream on karst by the household waste, the leak of fuel from gas station.
- d. The existence of extractive industry not paying attention on environmental rules.
- e. The abundance of decreasing debit water source or dry in dry season, disaster-prone area, specially landslide and flood in rainy season. Referring to spatial area plan on Trenggalek Regency, loaded on disaster-prone map set as protected area, they are flood-prone area, landslide-prone area, and tsunami-prone area. Landslide-prone area including Bendungan district, Dongko distric, Watulimo distric, Suruh distric, Trenggalek distric, Munjungan distric, Panggul distric, Tugu distric, Pogalan distric, Karang distric, Kampak distric, Durenan distric, and Gandusari distric (9 districts).

2. Undirected spatial planning.

Holistic spatial planning requires continuity system of living things life including biotic aspect (flora, fauna, microorganism), abiotic (Morphology, physical land), and social community aspect both in Trenggalek Regency administration and surrounding area. The damage of karst ecosystem generally happen because of the change of land function due to the lack of knowledge of function and service resulted by karst ecosystem. For instance from protection area to cultivation area. Besides, it can be caused by uncontrolled lime exploitation on karst ecosystem. Assumption that karst ecosystem classified to unproductive land, make it easily changed into mining area. The change on function of karst ecosystem caused to the disruption of ecosystem function specially related to water setting and availability on dry season.

Referring to spatial in Trenggalek Regency, Karst ecosystem area can be classified into protection and cultivation function, but because the basic data aren't entirely ready so the regulation in some areas isn't appropriate with their natural ecosystem. Karst ecosystem having protection function due to having special uniqueness related to endemic, rare or having high cultural value and local wisdom biota species. While karst ecosystem having cultivation function is due to its location on area cultivated by the community. Karst ecosystem also has uniqueness as mentioned before, so it needs instruction on its utilization. For instance, on its function an area belongs to protection function but in fact this area belongs to cultivation area. This condition as mentioned before happened in Trenggalek Regency. Based on spatial instruction in Trenggalek Regency seem that in karst ecosystem area which should have function as protection function, but located in production forest (*Hutan produksi-HP-*) or another utilizing area (*area penggunaan lain-APL-*) used by the community to agriculture cultivation, plantation, farming, and fishery. If it is on protection forest (*Hutan Lindung-HL-*) so theoretically the karst ecosystem area is safe. Therefore, spatial analysis using data and landscape information (physical, morphological earth origin) and natural ecosystem type need to be done for gaining potential instruction development area related to appropriate landscape to commodity that will be developed.

Referring to data of environment and forestry minister,

Trenggalek Regency has had karst ecosystem area width 53.506,67 ha spreading in 13 districts and ecosystem delination width 35.122,77 ha or 66% are recommended with protection function and its width 18.193,90 ha or 34% as instruction functioning as cultivation. The empiric data of width karst ecosystem area show protection function is only 12.137,68 ha or 35% which has been set on spatial area plan (Rencana tata ruang wilayah-rtrw-) Trenggalek Regency 2012-2032.

3. Rights admission and land management.

48,30% of Trenggalek regency administrative area is country forest in authorization of forestry department many of which bordering with government and community area. In some location, dispute has happened and problem related to rights admission and land management. Some of its completions have been facilitated peacefully by using joint management system, in this case, forestry department manages the main stand while community take advantage the surrounding by planting intercropping plants. But, in some locations still have potential and prone to be problems on rights admission and land management between community and forestry department.

4. Inappropriate land management related to the chosen of commodity product developed and produced from karts area.

Some commodities produced from this area are better not in from of wood product, so when the commodity product is taken, the area will not be opened after the logging activity. Opened karst area (without vegetation) clearly will worsen the condition on the area, due to the decrease ability to hold water from its upper vegetation. On high level rainfall area, water will directly flows on karst surface, or run down fast into the ground. The process of water and karst interaction get faster, so the brittle and easily fall stone remains will form a hole and gapping area.

5. Institutional problems on karts area management, priority handling, and related sectorial policy aren't in line, each sectorial has different priority policy on taking advantage of karst ecosystem.

The unavailability of management done by Trenggalek Government on karst ecosystem management. It is because karst ecosystem hasn't included on strategy and priority plan. The authority in setting karst ecosystem has been taken by central government, regional government can manage and take advantages only after being set by central government.

All this time karst area only includes in the setting of spatial area plan (RTRW). If the area doesn't include in RTRW category the AMDAL license from regency government will be published so that the management and its taking advantage can be done by province government. In other words, the authority of karst area management is in the province government. From authority aspects, regency government only analyzes whether the area includes in protection and cultivation area category appropriate to spatial area plan. Associated with management and taking advantage license, the province government has authority to publish business license in managing and taking advantage of the karst area.

6. Spatial has been karst ecosystem in Trenggalek Regency area referring to provisions of regional

regulations on spatial area plan (RTRW).

But, associated with karst ecosystem contained in RTRW provisions the imbalance and inappropriateness on geographical area is still found. By not having specific setting related to the karst area and the width on RTRW, the imbalance and disconnection of authority gained by Trenggalek Government, so there will be obstacles and challenges for regional government who has karst ecosystem to manage and protect ecosystem area, it has impact on area sustainability and community wealth. So, law as a means of community development and renewal has to be implemented on law making (regulation) on sectorial strategies related to environment and natural resource management especially in karst ecosystem area. The government policy to make regulation, in this case is Trenggalek Regency is so essential for ensuring the sustainability of protection and management of karst ecosystem area.

Problem formulation

From the background explained above, the author draw a line problem done in this research with these problem formulations:

1. How Identification and mapping on protection and management of karst area in Trenggalek regency?
2. How sustainability protection strategy and management on essential karst ecosystem in Trenggalek Regency?

Research Methods

This research is a legal research, according to F. Sugeng Istanto is a research implemented and enforced specially in law. Morris L. Cohen said, 'legal research is the process of finding the law that governs activities in human society'. Specifically, this research uses doctrinal research or normative research whose object is legal basis, legal systematics, legal synchronization level, and legal benefit with interview result in the field. Based on used characteristic research, this research is a descriptive research. A descriptive research is a research describing certain object and explaining related things or describing systematically facts or certain population characteristics in certain field factually and carefully. Referring to approach on law research, the author uses statute approach, conceptual approach, and philosophy approach. In normative law research the used data are secondary data consist of primary legal material and secondary legal material. In this normative research the researchers, for finding data and informations about law problems appear in community, are done in interview method and literature study. In interview method, there are two parties with different position, they are the one who find information called informan or respondent. Interview done with determined informan (the party who understand and /or know problems researched by the researcher). In this research, the researchers use qualitative descriptive analysis to get systematical descriptions and data related to the policy towards karst ecosystem management in Trenggalek Regency area, so the researcher can manage and present the systematic, accurate and accountable data.

Research Result and Study

Identification and mapping problem on protection and management karst area in Trenggalek Regency.

Trenggalek Regency is one of the regency in east java

province having potential natural resources, one of those is karst. Ecosystem karst area in Trenggalek Regency is large enough approximately 53.506,67 ha spreading in 13 districts and 108 villages with endokarst and exokarst characteristics and ecosystem delination. The karst area happens due to the clamp of two tectonic plates they are Indo-Australia plate and Eurasia plate so that the southern area becomes mountainous area covered by carbonate stone on outer side becomes karst area. Southern mountainous karst area consists of main stone typical miocene limestone and Mediterranean land spreading in almost of Dongko District, Bendungan District, Gandusari District, Kampak District, Karang District, Munjungan District, Panggul District, Pogalan District, Pule District, Suruh District, Trenggalek District, Tugu District, and Watulimo District. Based on hydrological karst area Trenggalek Regency is underwater storage ecosystem in community life, irrigation for agriculture and plantation surrounding area.

In Trenggalek Regency there are 6 ecoregions from totally 177 ecoregions in Indonesia determined by ministry of environment and forestry, they are:

1. Organic/coral land ecoregion complex Java
2. Volcanic land ecoregion complex Bantul-Nganjuk-Probolinggo
3. Volcanic mountain ecoregion complex Wilis Mountain
4. Karst hill ecoregion complex Gunung Kidul
5. Karst hill ecoregion complex Tulungagung
6. Structural hills ecoregion complex Wonoasri-Trenggalek

Each ecoregion complex in Trenggalek has main information, landscape characteristics and vegetation type. Identification of mapping problems in Trenggalek Regency karst ecosystem area attached in two fields, they are:

Protection and management policy on karst ecosystem

Generally, regulation on protection of karst area has been set by statute no. 32 2009 about environment protection and management, saying that protection and management plan have to pass some stages: (1) natural resource inventory (2) environment inventory (3) stipulation ecoregion area, and (4) arrangement of ecosystem protection and management plan (RPPLH). Arrangement of ecosystem protection and management plan must be based on ecoregion considering characteristics of climate, land, water, native flora and fauna and also interaction pattern between human and environment describing integrity system. Ecoregion stipulation is based on the equality of: (1) landscape characteristics, (2) watershed, (3) climate, (4) Flora and Fauna, (5) Socio cultural, (6) Economy, (7) community institutional, and (8) inventory result of environment. Ecoregion is ecosystem geography, generally interpreted as geographic unit group consists of various ecosystems that related each other and arranged naturally forming mosaic landscape pattern. Ecoregion stipulation resulting boundary as unity of analysis unit considering bigger system of ecosystem. The stipulation of this ecoregion becomes basis and has essential role on seeing relation, interaction, interdependency and dynamical advantage of various natural resource between some ecosystems in ecoregion area.

On other words, statute no. 32 2009 about environment protection and management mandates existence of standard criteria about the environmental damage. Standard criteria

about the environmental damage is a limit standard of characteristic change, physical, and or living environment which tolerable by environment to be able to keep its sustainable function. Related to karst ecosystem protection the standard criteria about the environmental damage is truly needed, because standard criteria about the environmental damage is an instrument on preventing environmental damage can give limits on business activities on karst area.

Sectorally, based on interview with office of public works of highways and irrigation added by Regional Development Planning, Research and Development Agency the regional secretariat of law explains that the regulation about protection and management karst area in Trenggalek Regency have referred to Ministry of Energy and Mineral Resources regulation no. 17 2012 about the stipulation of karst landscape area. Then, according to office of public works of highways and irrigation, about management and protection of karst ecosystem is in the Ministry of Energy and Mineral Resources authority so the foundation used as legal basis by regional government is only Ministry of Energy and Mineral Resources regulation. Public works of highways and irrigation also said that the regulation limits the regional government's authority for managing and taking advantage so the karst area authority isn't the regional government authority, but becomes the central government authority. Regional government is only able to set the area that doesn't contradict with spatial area plan.

From the Ministry of Energy and Mineral Resources regulation no.17 2012, at least there are 4 crucial things regulated on subsection (pasal) 3 Jo (juncto) subsection 4 verse (ayat) 1; subsection 5; subsection 6; and subsection 11, they are:

1. Karst landscape area is geology protection area which belongs to national protection area. The karst landscape area is an area that shows certain shape of eksokarst and endokarst (subsection 3 jo subsection 4 verse 1)
2. The stipulation of karst landscape area is done based on investigation and stipulation. (subsection 5)
3. Investigation can be done by the head of geological agency, governor, or regent/mayor and can cooperate with government research agency or regional government, university, and business entity. (subsection 6)
4. The stipulation done by the minister is appropriate with head of geological agency's proposal, meanwhile proposal given by the governor or regent/mayor will be evaluated by head of geological agency and further will be set by the minister (subsection 11)

Seeing the setting done before, there is clearly different on the deterioration setting in the Ministry of Energy and Mineral Resources regulation no.17 2012 toward arrangement, management and protection on karst area. In the Ministry of Energy and Mineral Resources regulation no. 1456K/20/MBM/2000 about the guidelines of karst area management gives more protection on karst area in subsection 14 verse 1, verse 2, verse 3, verse 4, and subsection 12 verse 1, they are:

1. Setting scope given about karst area management is more thoroughly and its focus isn't only set as protection area.
2. On this setting there are strict limitations on doing activities on the karst area classified into 3 classes, they

are 1st class, 2nd class, and 3rd class. So by the existence of karst classification will influence operational instruction in karst area, like:

- a. In the 1st class karst area no mining activities allowed. Other activities can be done provided that there is no potential to disrupt endokarst and eksokarst morphology, classification, and karst function. (subsection 14 verse 1 and 2)
- b. In the 2nd class karst area mining and other activities can be done after completing environmental study (AMDAL, UKL and UPL). (subsection 14 verse 3)
- c. In the 3rd class karst area mining can be done based on constitution. (subsection 14 verse 4)
3. On the Ministry of Energy and Mineral Resources regulation no. 1456K/20/MBM/2000 isn't only focused on protection of karst ecosystem function as a groundwater recharge area, water resource or groundwater storage media but also about the protection of karst ecosystem as endemic, native flora and fauna habitat. Karst area contains unique flora and fauna classified in 1st class area that must be protected. (subsection 12 verse 1)

Broadly speaking, based on the Ministry of Energy and Mineral Resources regulation no. 1456K/20/MBM/2000 article 13 stated that the position of 1st class karst area equals to karst landscape area as set in the Ministry of Energy and Mineral Resources regulation no. 17 2012 isn't explicitly confirmed about the limitations of activities can be done in karst landscape area but implicitly mandates that karst landscape area need protection, preserved, and controlled utilization.

Besides the Ministry of Energy and Mineral Resources regulation no. 17 2012 giving bigger portion on central government in managing karst area is by setting stipulation no 23 2014 about regional government. Actually by setting regional autonomy, authority has been given to the regional government to manage their own area. But, on its implementation tug-of-war still happened between province government and regent/mayor government. It also happens in environment sector specially which is located on authority problem to give mining license. Article 14 and article 15 regulation no.23 2014 about regional government explains that regent/mayor government no longer authorized to give mining license, which originally authority of regency/city now becomes authority of province

Reading in the article 14 stipulation number 23 of 2014 about regional government, stated that '*administration of government affairs forestry sector, marine also energy and mineral source is divided between central and province government*'. While article 15 stipulation number 23 of 2014 about regional government stated that '*the division of government affairs is congruent between central and province government and regency/city listed in attachment that is inseparable part of this statute*'. On attachment of statute number 23 of 2014 about regional government regarding the division affairs in energy and mineral source on point cc. it can be seen in this attachment that regency/city doesn't have authority at all in mineral and coal mining license's publishing.

Effect from statute number 23 of 2014 validation that licensing authority shifts regency government to province government becomes obstacle in doing law enforcement, one of which is supervisory affairs. Based on the opinion of

Housing office residential areas and the environment, explaining that mining supervision done directly by the central government and the regional government only plays helping role, so the law enforcement regarding illegal mining in Trenggalek Regency will become weaker. License through the province government increasing the number of miner’s unwillingness to get license because many obstacle felt when they have to be licensed from regency to province.

Referring to the Ministry of Energy and Mineral Resources regulation number 17 of 2012, management of karst area has been done by regional work unit (Satuan kerja perangkat daerah-SKPD-) Trenggalek regional government for preserving karst and protecting essential karst area that has potential and uniqueness. Important aspects in karst ecosystem is arrangement of karst water resource, tourism aspect, agricultural and forestry aspects, mining aspects, etc. furthermore in making management efforts of karst ecosystem done arrangement listed in spatial area plan 2012-2032.

Spatial area plan (RTRW) is done to manifest Trenggalek Regency as a productive and sustainable area of agribusiness, industry, minneapolis and tourism. For manifesting the purpose, so area management and spatial has been developed in form of policy and strategy stabilization protection area and policy and development of cultivation area. Policy stabilization protection area including function utilization and control strictly sustainable development basis, developing risk management on prone-disaster area. Strategies to utilize function and control strictly development basis, involving:

1. Stabilizing function of protected forest area
2. Increasing the quality of water absorption area
3. Stabilizing local protection area; and
4. Stabilizing function and utilization value on nature reserve area, nature preservation, and cultural heritage.

While strategies to develop risk management on prone disaster area

Involving:

1. Controlling developed area on prone disaster area
2. Stabilizing geology protection area
3. Developing disaster mitigation system
4. Setting prone disaster area zone
5. Developing tract and spatial of disaster evacuation

Developing policy of cultivation area including competitive potential local raw material used industry development and development of cultivation areas based on the utilization of regional potential. Strategy to develop competitive potential local raw material used industry, involving:

1. Developing centers for small, medium and large industrial areas
2. Developing promotion center and marketing industry product
3. Increasing infrastructure supporting industry area
4. Developing new industry on potential area.

While the strategy to develop cultivation areas based on the utilization of

Regional potential, involving:

1. Development of production forest area
2. Setting and developing community forest area
3. Developing mining area
4. Arranging and controlling area for industrial purpose
5. Increasing tourism development
6. Developing area for settlement purpose
7. Arranging and controlling informal sector; and
8. Developing costal area and small islands

Condition of karst ecosystem function instruction on RTRW in detail can be seen in detail in the following table.

Table 1: Karst ecosystem function instruction on RTRW of Trenggalek Regency

Spatial	Karst ecosystem function instruction (HA)	
	Preservation	Cultivation
Preservation Area	12.371,68	2.575,77
Preservation Forest	1418,47	1.671,98
Preservation Karst Area	9.554,94	76,66
Landslides Prone Area	453,24	332,8
Embung Border	36,65	25,47
Water Spring Border	461,11	228,24
Beach Border	169,84	131,02
River Border	169,35	60,43
SUTET Border	1,25	
Reservoir Border		8,26
River	106,83	40,91
Cultivation Area	22.941,10	15.613,33
Permanent Production Forest	14.963,49	8.675,75
Community Forest	648,56	373,67
Plantation	1.398,53	1.882,51
Rural Settlement	2.159,32	909,07
Urban Settlement	460,28	395,37
Irrigation Rice Field	189,56	87,45
Rain-fed Rice Field	412,44	1.871,15
Moor/Field	2.708,92	1.478,36
Total	35.312,77	18.193,90

From the total width of karst area in Trenggalek Regency approximately 53.506,67 ha only 65% or 22.941,09 ha width is set as preservation function karst ecosystem

instruction whose purpose in RTRW is as cultivation area and only 35% or 12.371,68 ha width is set as preservation area. While on cultivation function karst ecosystem

instruction is only 14% or 2.499,12 ha width in RTRW set as preservation area. So the karst area arrangement in spatial area plan is still being conflict. There is still overlapping karst ecosystem function instruction with Trenggalek Regency RTRW of 2012-2032.

Karst area arrangement put into Trenggalek Regency RTRW is different with data inventory taken by Ministry of Environment and Forestry. Based on data inventory taken by, Ministry of Environment and Forestry karst area in Trenggalek Regency based on its characteristic, exokarst and endokarst also ecosystem delination width 35.312,77 ha or 66% is recommended with preservation function and width 18.193,90 ha or 34% as instruction functioning cultivation.

Based on Regional Regulation in Trenggalek Regency number 15 of 2012 about spatial area plan in Trenggalek Regency 2012-2032, preservation area in Trenggalek Regency consist of: preservation area (17.620 ha); area that gives preservation to lower area (14.699 ha); local preservation area (3.985 ha); nature reserve area, natural preservation; cultural heritagr; prone disaster area; geology preservation area; other preservation area; Urban green open space (1.491 ha).

From various preservation area mentioned above, Trenggalek Regency regional government's attention to karst ecosystem has been accommodated in these preservation area:

1. Area that gives preservation to lower area, in form of water absorption area in all districts. As known before that karst area is area having high potential water storage both in form of water spring, lake, underground water, etc. the preservation form is preservation towards water absorption area.
2. Local preservation area, consist of:
 - a. Water spring border, width ± 1.545 ha located in all districts, the preservation forms are arrangement and preservation area around spring.
 - b. Embung border, width ± 111 ha, located in Kampak District, Panggul District, Tugu District, Suruh District, Bendungan District, Watulimo District, and Pule District. The preservation forms are prevention and controlling cultivation activiyies.
 - c. Beach border, width ± 1.233 ha located in Watulimo District, Panggul District, and Munjungan District. The preservation actions consist of: Activities control around beach border, restoration of costal area preservation function, and tourism area development.
 - d. River border, width ± 1.959 ha located in all districts, the preservation actions done by: area development, river border arrangement, and tributary border arrangement.
3. Geology preservation area, consists of:
 - a. Karst geology preservation area, width ± 10.684 ha spreading on Bendungan District, Panggul District, Watulimo District, Dongko District, Gandusari District, Kampak District, Karang District, Munjungan District, Pogalan District, Suruh District, Trenggalek District, and Tugu District.
 - b. Karst disaster prone area consists of:
 - a. Earthquake, located in all districts
 - b. Tsunami, width ± 5.538 ha consists of Watulimo District, Munjungan District, and Panggul District.

Manifestation of geology preservation area consists of karst preservation area and cultural area control in karst area. While prone geology disaster area prevention consists of tsunami prone area handling and landslide prone area handling. Besides purposing for prevention area, Trenggalek Regency Government is also set karst ecosystem area as cultivation area. Cultivation area set in Trenggalek Regency's RTRW consists of: Production forest purposing area (44.169 ha), community forest area (2.663 ha), agricultural purposing area, plantation purposing area (5.93 ha), fishery purposing area, mining purposing area, industry purposing area, tourism purposing area, settlement purposing area, costal area and small islands, and other purposing area. Karst ecosystem area whose spatial is set in cultivation area, some of which are natural tourism purposing area, and mining purposing area, especially commodity stone mining located in all districts. In addition to preservation and cultivation area above, Trenggalek Regency's RTRW is also set about strategic regency area, consists of:

1. Strategic area from economic development point of interest;
2. Strategic area from function and environment carrying capacity point of interest; and
3. Other strategic areas. In this case, karst ecosystem in Trenggalek Regency including tourism strategic area (cave tourism object in Watulimo District), and strategic area in terms of function importance and environment carrying capacity of karst area located in Bendungan District's, Panggul District, and Watulimo Districts.

This strategic area manifestation is done through protection of preservation karst area. Related to spatial arrangement above, Trenggalek Regency RTRW is also set about General stipulations of Zoning Arrangement for Karst Preservation Area with the following stipulations:

1. Allowed with condition limited cultivation area utilization.
2. Allowed with condition for education and research activities purpose; and
3. Not allowed for activities creating harm.

While general stipulations of zoning arrangement for geology prone disaster area, as following:

1. Allowed to build supporting building
2. Allowed with condition limited cultivation area utilization
3. Allowed with condition making building appropriate to natural geology prone disaster level
4. Allowed with condition to build infrastructure.

General stipulation of zoning arrangement for strategic area function importance and environment carrying capacity is arranged with following stipulations:

1. Allowed for revitalization activities on both central zone and supported zone.
2. Allowed for infiltrations well development.
3. Allowed with condition natural tourism activities, research, and education.
4. Allowed with condition preservation area having high economic value utilization.
5. Not allowed to do area functional shift disturbing

- preservation function; and
6. Not allowed settlement development and seasonal crop cultivation in preservation area.

Institutional management and protection of karst ecosystem

Although Trenggalek Regency SKPD having authority to do arrangement, management and preservation towards karst ecosystem area has done management, unsynchronized imbalance towards activity done to protect karst ecosystem in Trenggalek Regency. Institutionally, in attempt to protect and manage karst area in Trenggalek Regency hasn't been done like regular activity to cooperate with authorize government agencies in related sector and do socializations also community coaching. Socialization and coaching done in order to make community awareness not to do not allowed activities on the karst area. Community will understand which karst incudes KBAK and which doesn't, there will be no settlement on karst area.

Based on result of interview with SKPD Trenggalek Regency Government, according to Housing office residential areas and the environment (PKPLH) environment sector who has authority to propose management and utilization said that natural karst source hasn't been done management and utilization not caused as strategic issue and priority program. Then, according to it institution related to environment problem handling in Trenggalek Regency is only a form of sector not as true agency so it has influence in management because of limited labor and budget. Means that this institution get limitation in modality, they are amenities, facilities, and infrastructure. According to Housing office residential areas and the environment (PKPLH) environment sector, other problem of karst ecosystem management and utilization in Trenggalek Regency there is different data inventory between data in RTRW and the fact. Based on its geographical location, overlapping of area arrangement between preservation and cultivation happen. Besides, in doing coordination with authorized agencies, don't have the same view and interest so that the coordination becomes difficult.

While, according to SKPD from PUPR agency, besides due to limited authority caused by Ministry of Energy and Mineral Resources regulation number 17 of 2012 as foundation and/or base for doing karst ecosystem arrangement, there also management problem caused by karst area existence on the forestry area and personal area. So there must be coordination which allow different view and interest. Furthermore, Trenggalek Regency government doesn't support with no regulation formed by executive and legislative institution in order to get legal foundation in placing essential karst ecosystem arrangement based on sustainable development.

According to SKPD from Bappedalitbang, meeting between various SKPD, one of which is PKPLH environment sector, SETDA legal sector, PUPR spatial sector to discuss karst ecosystem arrangement in RTRW, but not all SKPD have the same view and interest, from SKPD PUPR Agency spatial sector and SETDA, legal sector don't support karst ecosystem being placed in RTRW in accordance with study conducted by LKPLH because there is no legal foundation except referring to Ministry of Energy and Mineral Resources regulation number 17 of 2012 so it is worried about legal impact in the future. Added by LKPLH environment sector said that KLHK offering help in form of

study to arrange stipulation, regent regulation independently and specifically about environment management and protection accommodated protection essential karst area in Trenggalek Regency, but this offer isn't followed up by Trenggalek Regency government so until this time Trenggalek Regency Government doesn't have the regulation.

Effect of institutional and regulation problem creates community's awareness factor on importance of protecting karst area decreases. There will be less aware of preservation karst area sustainability and environment in it both living and unliving. Ignorance on importance of karst area prevention and in doing commercial activities on karst area without regarding karst area preservation both living and non-living can create effect on next generation some of which are 3 things, they are:

1. Over consumption towards quality natural resource, makes future generation have to pay much for consuming the same natural resource.
2. The consumption of natural resources whose best advantages are now still unknown excessively is very detrimental to the interest of future generation, because they have to pay in-efficiency in consuming those natural resources done by previous and now generation.
3. Full consumption of natural resources done by previous and now generations make future generations don't have high variation of natural resources.

Therefore institutional reinforcement has important role and keep referring to legal principles in article 2 stipulation number 32 of 2009 about environment protection and management so it is hoped that more sustainable protection and management of karst area efforts will be realized, both preventively and repressively, optimal and can provide justice, especially among generations, also legal certainty for landscape karst area. If constitutionally, regulation and legal culture in the area is strong there will be possibility of sustainable, environment friendly of protection and management on Trenggalek Regency karst area environment materialized well.

Strategy of Protection and Management of Ecosystem Karst Area in Trenggalek Regency

For creating karst ecosystem in Trenggalek Regency utilization that can create community's economy and still keeping sustainability of karst ecosystem function, so karst ecosystem arrangement and management is needed. To manifest it, done Identification and karst ecosystem delination also analysis on preservation and cultivation function, as instruction of karst ecosystem utilization. Existing policy and field utilization which are inappropriate with karst ecosystem function need managing in order not to create karst ecosystem damage. Therefore, there are some instruction strategy which can be presented as reference for Trenggalek Regency in doing arrangement, management and utilization essential karst ecosystem area based on sustainable development, they are/;

Instruction Function

Based on endokarst and eksokarst characteristics in Trenggalek Regency as explained in first problem formulation, from karst ecosystem width 53.506,67 ha can be identified 35.312 ha (66%) which can be recommended as preservation function instruction and 18.193,90 ha (34%)

as cultivation function instruction. Remembering data karst ecosystem characteristic in Trenggalek Regency on some locations are still unavailable, so those locations are recommended as cultivation function instruction.

From overlapping result between karst ecosystem function and spatial area plan (RTRW) Trenggalek Regency 2012-2032, 50% or 26.729,69 ha karst ecosystem is located in forestry area and another 50% in other functioning area

(Areal Penggunaan Lain-APL-). Forest function area located on karst ecosystem in form of preservation forest (Hutan Lindung-HL-) width 3.090,45 ha and production forest (Hutan Produksi –HP-) width 23,639,24 ha. On permanent production forest area, there is karst area of protection function instruction width 14.936,49 ha. The detail of function instruction on karst ecosystem in forest area can be seen in the table below.

Table 2: Function Instruction on Karst Ecosystem in Forest Area

Area Function On Spatial	Function Interaction On Karst Ecosystem (HA)		Total	%
	Preservation	Cultivation		
Forest Area	16.381,96	10.347,73	26.729,69	50
Preservation Forest	1.418,47	1.671,98	3.090,45	5,8
Permanent Production Forest	14.963,49	8.675,75	23.639,24	44,2
Other Functioning Area	18.823,99	7.800,46	26.624,45	49,8
River/Water Body	106,83	40,91	147,74	0,3
Total	35.312,78	18.189,10	53.501,88	100

Careful managing on karst ecosystem found in production forest area is still needed, reckon karst ecosystem is prone to environmental damage and changing. Considering karst ecosystem characteristic, environment quality on karst ecosystem, issue and problem on natural resource, spatial RTRW, and existing field utilization so analysis on karst ecosystem utilization instruction in Trenggalek Regency can be done. Based on community economic structure, agriculture, forestry, and fishery are dominant business sectors in Trenggalek regency. Besides having potential on those sectors, Trenggalek Regency has also potential in managed and worth selling tourism as many as 21 natural tourism, some of which are located in karst ecosystem area. From observation result there are karst ecosystem characteristics in form of cave, water spring and lake as many as 42 locations which can also be tourism destination. Based on existed secondary data listed 361 water springs (water spring and river) decrease to 318 water springs, debit and the water quality. Existingly, in some villages located on karst ecosystem drought or scarcity of water resource often happen. Therefore needed environment quality recovery through vegetation having water conservation and community economy function. Vegetation needs for recovering environment quality through re-vegetation which has water conservation and community economy function. Re-vegetation needs for environment quality recovery is done through field closing analysis especially on preservation function instruction karst area.

Management instruction

Based on function instruction and utilization instruction also Government Regency policy existing and environment quality, so needed effort to manage karst ecosystem in Trenggalek Regency as essential ecosystem. Therefor there are some management instructions based on existing utilization and environment quality, as following:

1. Pollution control and environmental damage

Effort of water pollution control is done towards potential pollutants come from domestic waste (water waste and feces), manure, and landfill in Srabah Village.karst stone condition that easily releases water, so the septic tank construction doesn't use absorption system but use suction system. Likewise the use of manure excessively is decreased and increasing its use, while with the existing of landfill in

Srabah Village, needs conducting review again related to risk of polluting water in Banging river and underground water. Construction in Watulimo, Panggul and Munjungan is planned in order not to be in karst ecosystem.

2. Logging arrangement

The existence of industry forest remains in karst ecosystem width 23.639,24 ha some of which located in karst ecosystem preservation function width 14.936 ha is instructed to

Forest producing non-wood utilization and width 8.675,75 ha on cultivation function instruction, logging arrangement is done so that there will be no damage on water resource and other karst characteristics. Also, logging arrangement on community forest plantation located on karst preservation function instruction.

3. Animal Protection

For supporting plantation and agricultural development on karst ecosystem and its surrounding, the existence of bats needs identification and protection effort both habitat and food sufficiency.

4. Institutional

For Trenggalek Regency karst ecosystem management effectiveness, institutional arrangement is done with considerations:

- a. The existence in forest area, there are forestry agency, forest processing unit (Kesatuan pengolahan hutan – KPH-) both inform of KPHL (protection forest) and KPHP (production forest) who has authority to manage forest area.
- b. The existence is not in forest area (other purposing area –APL-), instructed towards village institutional and can be in the form of village-owned enterprises
- c. For supporting the institutional management above, so in Trenggalek Regency level needs forming coordination/collaboration forum Trenggalek Regency karst ecosystem management by Trenggalek Regent.

Coordination/collaboration forum of karst ecosystem management is one of institution forming program developed by ministry of environment and forestry through karst essential area management based on coordination multi-parties. Collaboration program is developed with

basic purpose for integrating and mainstreaming karst ecosystem protection and management effort on program or the authority attached to each stakeholder regarding karst ecosystem utilization. to bind formally among relevant stakeholders, then this collaborative forum is determined by the Regional Head and in its structure this institutional forum can be attended by representatives of the central government, local government, communities, LSM, academics, the private sector and related stakeholders.

This collaboration forum can be done by promoting deliberation. Stakeholder deliberation is a collaborative building among multi-stakeholder purposing to:

1. Making an inventory of the ecosystem problems complexity protection and management.
2. Ensuring sustainable community's participation in managing karst ecosystem.
3. Ensuring legal foundation for community's participation.
4. Movement of law.
5. Increasing optimal field utilization model.
6. Building communication mechanism.
7. Developing supporting activities like nursery.
8. Empowering the existence of LMDH (forest village community) to work effectively, introduce technology, appropriate capital assistance and agroforestry problem.

Deliberation of the parties in the relational dialectical theory of Leslie Baxter and Barbara Montgomery is interpreted as:

1. A form of relation or dialog
2. Dialogue creates an opportunity to achieve a unity in diversity
3. Dialogue is discourse, refers to ideas created or made in communication

Deliberations of the parties whose members are institutions related to karst essential ecosystem protection and management as following:

1. Developing a plan of essential karst ecosystem area protection and management.
2. Identifying the need of essential karst ecosystem area development and management.
3. Increasing prosperity, community income, and conservation support.

Stakeholder deliberations involve elements of the central government (LKH and ESDM) local government (Bappedalitbang, SETDA, PKPLH, Perhutani and PUPR), village government, academics, LSM, communities. Deliberations of stakeholders in the essential karst ecosystem area protection and management control the implementation of the program related to the community in karst ecosystem area.

A stakeholder deliberation to initiate a stakeholder in essential karst ecosystem area collaboration consisting of 3 phases. These phases include:

1. Preparation phase
2. Consensus building phase
3. The monitoring approval phase

First, this preparatory phase is carried out through synergy between various programs organized by communities around the area, the karst ecosystem managers and Trenggalek Regency government and provincial government. This synergy is expected to result in

clarification of the roles and responsibilities of stakeholders regarding the conservation of natural resources of the karst ecosystem that supports the achievement of sustainable development. In this phase, activities are developed for community development, natural resource management is planned, which includes the existence of villages with karst ecosystems area. In the activities of community representatives linked in LMDH who will develop natural resource management plans for each village. Output activity is a matrix program that proposes activities, this approach is important as a first step to build a program that is synchronized with the protection and management of karst ecosystems area and local government development programs.

The next stage is the development of mutual consent and consensus. The purpose of the activity is to agree on a synergized program, clarify the roles and responsibilities of stakeholders in implementing the program, and establish a partnership forum to build program implementation. Meanwhile, the activities carried out in the consensus phase were to facilitate stakeholder cooperation workshops at the Regency level. This activity aims to present the program design draft that has been developed during the preparation phase for all parties who have been involved in the preparation of the program in order to review the objectives so that it will avoid overlapping the drafted programs. The result of the activity is a multi-partnership program.

After the consensus results are agreed, it will be followed up with a workshop that examines the roles and responsibilities between stakeholders in implementing a synergized program. The responsibility of the parties refers to Osborne and Gaebler who refer to re-interventing government steps which include:

1. The government is positioned as a facilitator rather than doing all operational activities.
2. Empowering communities to be able to speak up, and at last can participate in protecting and managing essential karst ecosystem area.
3. Give sufficient authority to the regional head in managing the area, thus facilitating coordination with related agencies in the regions and able to accommodate the interests of the community.
4. Services to the community must be based on real needs and the government must be responsive to changing needs.
5. The government must be able to take preventive action towards Threat of damage to the karst essential ecosystem area.

The discussion on the roles and responsibilities of the parties was continued with the formation of 'communication Forum'. This forum is a main integrated of area protection and management. The institutions involved in it must comply with the protection and management activities in the area also empower the communities in the karst ecosystem area. In the performance of this forum has duties as: (1). Arranging a draft plan for the management of essential karst ecosystem areas; (2). Identification of area protection and management development needs; (3). Accommodate activities for integrated management. Activities conducted by the forum, purposing to improve community's welfare, supporting karst ecosystem area conservation and evaluating the results of management activities. It is hoped that the forum can work optimally which will then be integrated into

regional development programs as well as in karst management plans.

Communication forums must develop cooperation in the protection and management of essential karst ecosystem areas that are built from social structures in the community. The collaboration starts from the lower level, village, which involves the local community in planning, implementing, and monitoring the process. Any activities done in the consensus phase is facilitating stakeholder's cooperation workshop at the Regency level. This activity aims to present the designed program plan that has been developed during the preparation phase for all parties who have been involved in programming in order to review the objectives so that it will avoid overlapping the programs compiled. The result of this activity is a multi-partnership program. After the consensus is agreed, it will be followed up with a workshop that examines the roles and responsibilities between stakeholders in implementing a synergized program. After the roles and responsibility arrangements are clear, it is hoped that a partnership forum will be established in the workshop. After the partnership forum and multi-stakeholder program have been prepared, it will officially be reported to the Regent for approval, including the signing of MOU between the parties involved in the partnership forum. In accordance with the above efforts, it is necessary to establish policies by regents, including:

1. Strengthening of spatial area plan utilization, which includes karst ecosystem and karst ecosystem preservation function instruction as preservation area. For determination as a preservation area, it can be done by using various criteria such as the existing karst preservation area, water catchment area or groundwater recharge area.
2. Arranging a plan for the protection and management of the karst ecosystem in Trenggalek Regency, either independently or integrated in the plan for environmental protection and management in the Trenggalek Regency area.

Conclusion and Suggestions

Based on the description of the results of the discussion and research, the conclusions can be drawn as following:

1. From the identification result and problems mapping towards the karst ecosystem area in Trenggalek Regency, the policies done in structuring, managing and protecting the karst ecosystem area in Trenggalek Regency cannot be managed and utilized because the ecosystem factor is not a strategic issue and hasn't become a priority program. The cause of this is due to the portion given to local governments is smaller, the bigger portion is in the central government authority. In addition to a smaller portion of authority in the management and utilization sector, the portion of law enforcement against the violation of illegal mining is also not given a large portion by stipulation number 32 of 2014 about regional government. This can have a degradation impact on the environment. The efforts of the central government in doing efforts to protect the karst ecosystem cannot be said to be maximized because there are still many disharmonious regulations among them are Statute no. 32 2009 about protection and management of environment, Ministry of Energy and Mineral Resources regulation number 17 of 2012 about determination of karst landscape area, regulation

no.23 2014 about regional government and Trenggalek Regency regional regulation number 15 of 2012 about spatial area plan (RTRW) Trenggalek Regency 2012-2032. The result of this regulations disharmony has an effect on the related SKPD institutions. Because they have different basic views and interests, at last, the karst ecosystem area is not managed and utilized as a material for sustainable development and keep paying attention to the karst ecosystem area as an essential area.

2. The strategy that can be done by Trenggalek Regency regional government is by doing function instruction, utilizing instruction, and management instruction. Function instruction is by doing re-identification of the karst ecosystem placement in the RTRW which is shown in the development of the essential karst ecosystem so that it has a beneficial impact on the community's economy. After identification is made for its function instruction, then it can be instructed to use the instruction which includes in the fields of agriculture, plantation, forestry, and ecotourism. To manifest these, a management instruction is needed which includes improvements and strengthening in the areas of regulations, institutions, animal protection and logging of timber and non-timber forests.

Recommendation

1. With the issue of disharmony of regulatory policies, the SKPD which is authorized to protect and manage the karst ecosystem in Trenggalek Regency must have one goal in building interests so that institutional disharmony does not occur so that protection and management of karst ecosystem areas based on sustainable development can have a positive impact on both communities. From a socio-historical perspective as well as in an economic-political perspective.
2. The Regent as the regional head needs to conduct a review of the RTRW which can refer to a study conducted by the ministry of environment and forestry. from the results of a study conducted by the Ministry of Environment and Forestry on the Karts Ecosystem in Trenggalek Regency based on the identification of an area of 35,312.77 ha or 66% of the karst ecosystem which is recommended as a karst ecosystem preservation instruction and an area of 18,193.90 ha or 34% as a karst ecosystem cultivation instruction. Then forming a development program for the essential karst ecosystem area in the framework of karst ecosystem preservation, through the stages of identification and inventory of potential karst ecosystem data, analysis based on the suitability of criteria, delination areas, arranging management institutions through the formation of collaboration forums, and arranging management action plans involving various stakeholders. The essential karst ecosystem area is managed collaboratively based on an integrated action plan document in order to realize a sustainable use of the karst ecosystem. The action plan document that is formed is used as a guide and / or reference in determining priorities for the management and utilization of the karst ecosystem for stakeholders in Trenggalek Regency so that there is no longer any disharmony between the institutions. In addition to the existence of an action document as a guideline for the

authorized institution, Regent must also provide a strong foundation in the management of the karst ecosystem by establishing a regulation in the Trenggalek Regency area regarding the protection and management of the karst ecosystem so that it can have an impact on increasing the target of protection / conservation of the karst ecosystem in Trenggalek Regency for the sake of increasing welfare surrounding communities and for future generations.

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