MDG:F
MDG ACHIEVEMENT FUND
MDG-F 1656: Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change

ALBAY INTEGRATION OF CLIMATE CHANGE RESPONSES IN CLUPs

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Methodological Framework

- Identify parameters for the review and revision of CLUPs;
- Modify procedural guidelines for CLUP preparation to allow for the integration of climate change considerations;
- Develop capacity building program to enrich the planning skills of local government planners and other key stakeholders;

methodological framework

- Strengthen the institutional structure for CLUP preparation and implementation; and

- Draw out plan for the institutionalization of the tested framework for nationwide implementation

Salient Features and elements methods and procedures

- Assessment of the existing and potential natural and anthropogenic threats (e.g., deforestation, land degradation, pollution and rapid population growth) to development and public safety including current and future climate change and variability, and related hazards and risks (e.g., floods, droughts, landslides, typhoons) and their interactions with key local development and environmental protection processes

Salient Features and elements methods and procedures

- Review of existing procedural guidelines for the preparation of CLUP focusing on the overall framework, general guiding principles, actors and players, and key tools and methods for data collection and analysis.

Methods and Procedures

- Assessment of the extent to which the existing CLUPs can respond to current and future natural and anthropogenic threats to development and public safety and identify areas for improvement (i.e., policy framework, institutional set up, technical procedures) to increase responsiveness of CLUPs to all threats and factors constraining local sustainable development goals (i.e., food security, water security, poverty reduction, natural resources conservation, etc).

- Drafting and testing of a protocol for the review and revision of CLUPs in selected LGUs including process documentation that will serve as basis for the finalization of the revised guidelines and procedures for the preparation of CLUPs; and

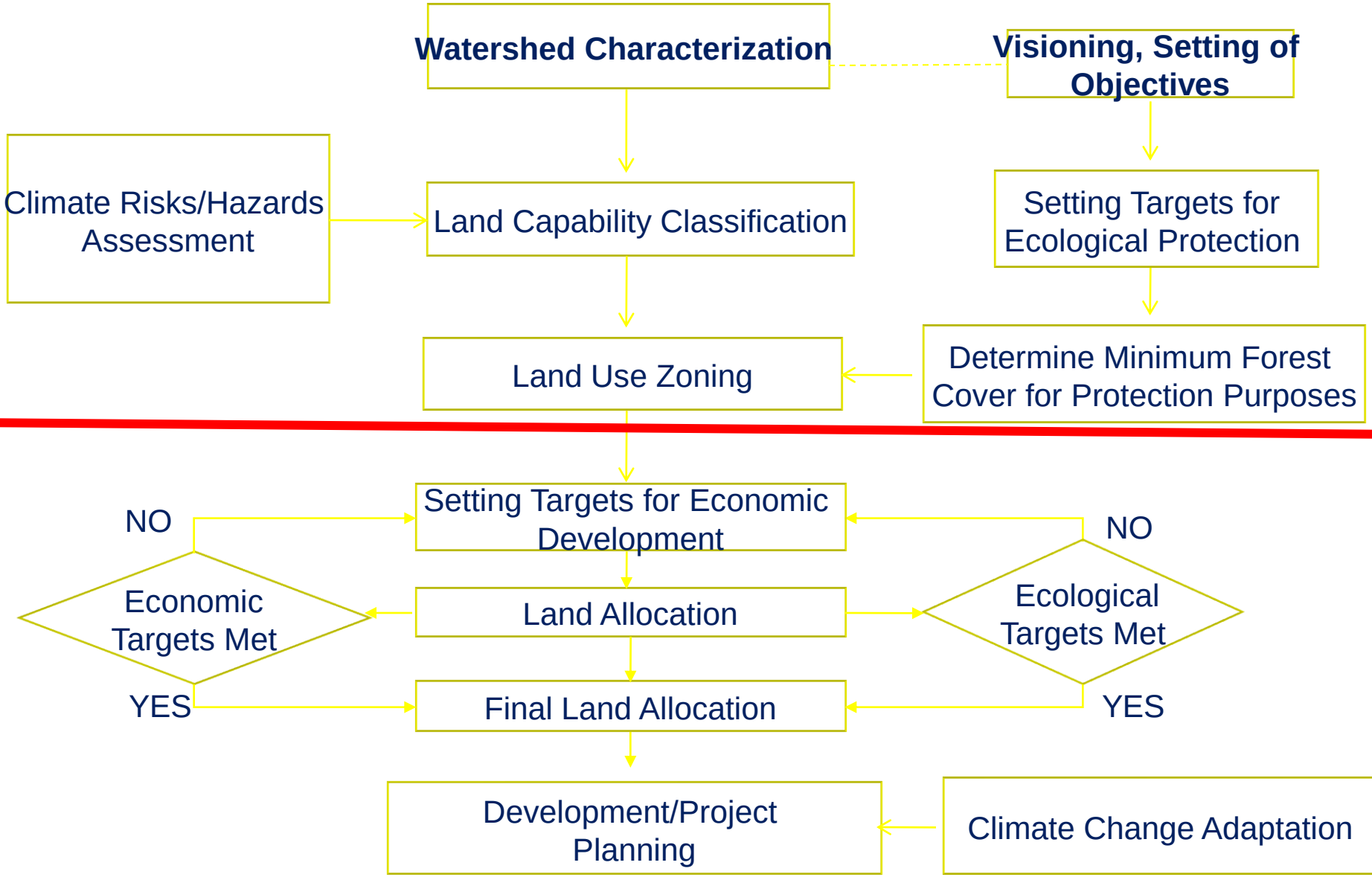
- Institutionalization of the finalized revised guidelines and procedures for nationwide implementation.

key principles and approaches

- Integrated and watershed-based assessment and planning framework that will allow comprehensive treatment of all development concerns and issues in the context of a changing climate

- Participatory process will be used in all phases of the study to ensure that the outputs will be responsive to the issues and concerns that truly matters to the community of stakeholders and to the overall attainment of sustainable local development objectives in synergy with national development priorities and goals; and

- Science-based decision making processes that will produce options with high likelihood of successfully addressing the issues and concerns at hand.


Watershed Characterization
Visioning, Setting of Objectives
Climate Risks/Hazards Assessment
Land Capability Classification
Setting Targets for Ecological Protection
Land Use Zoning
Determine Minimum Forest Cover for Protection Purposes
Setting Targets for Economic Development
NO
Economic Targets Met
YES
Land Allocation
NO
Ecological Targets Met
YES
Final Land Allocation
Development/Project Planning
Climate Change Adaptation

Modify/Adjust to integrate effect of increasing rainfall & typhoon intensity

Volcanic Hazard Map

Earthquake Induced-Landslide

Rainfall-Induced Landslide

Flood Hazard Map

Wind Hazard Map

Soil Erodibility Map

Vulnerability Maps

Zoning Map

Forests Needed to Protect Ecosystem Services

Zoning Map X Proposed Land Use

Existing/Current Land Use Map

1. Proposed Land Uses in appropriate zones
2. Proposed Land Uses in inappropriate zones

Recommendations to

-minimize or avoid damage to property, loss of life, damage to ecosystems

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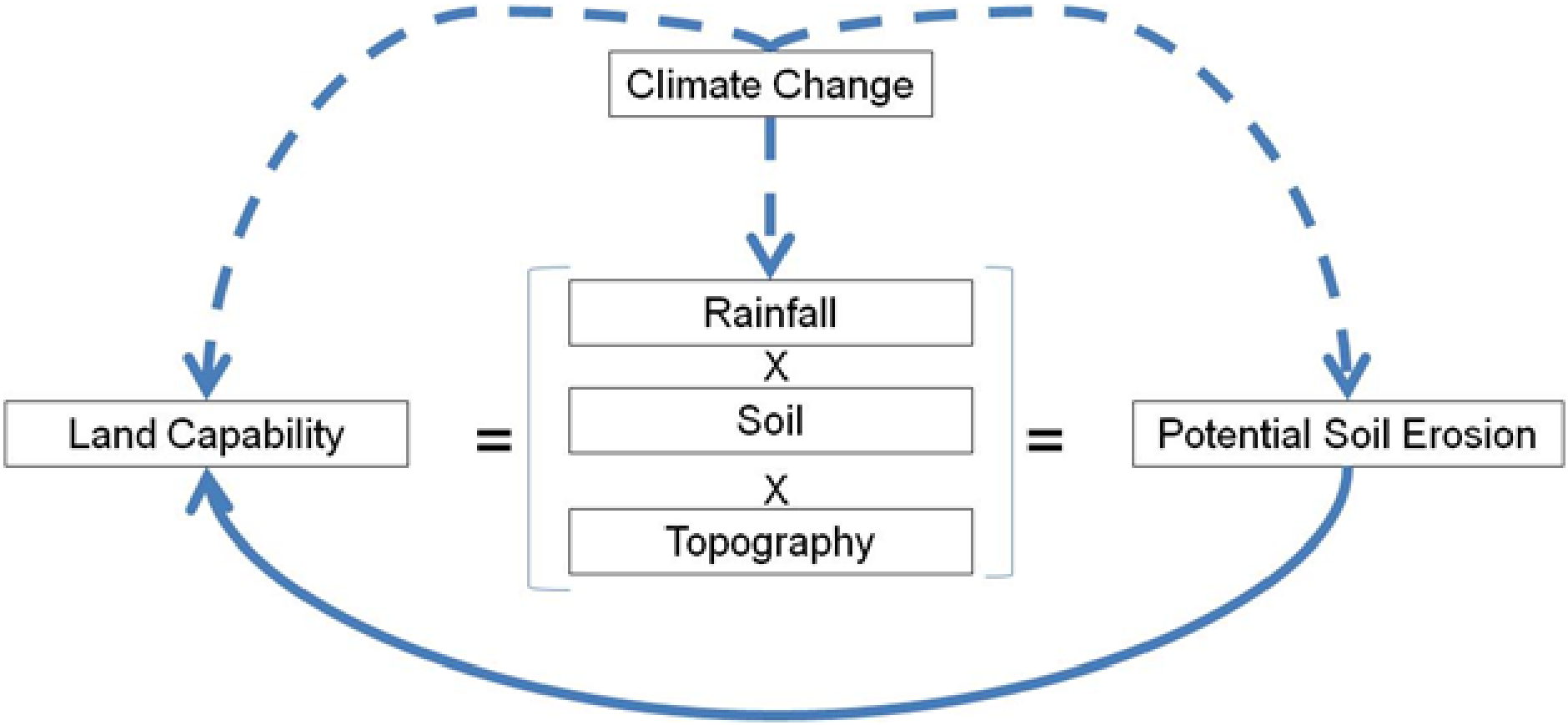
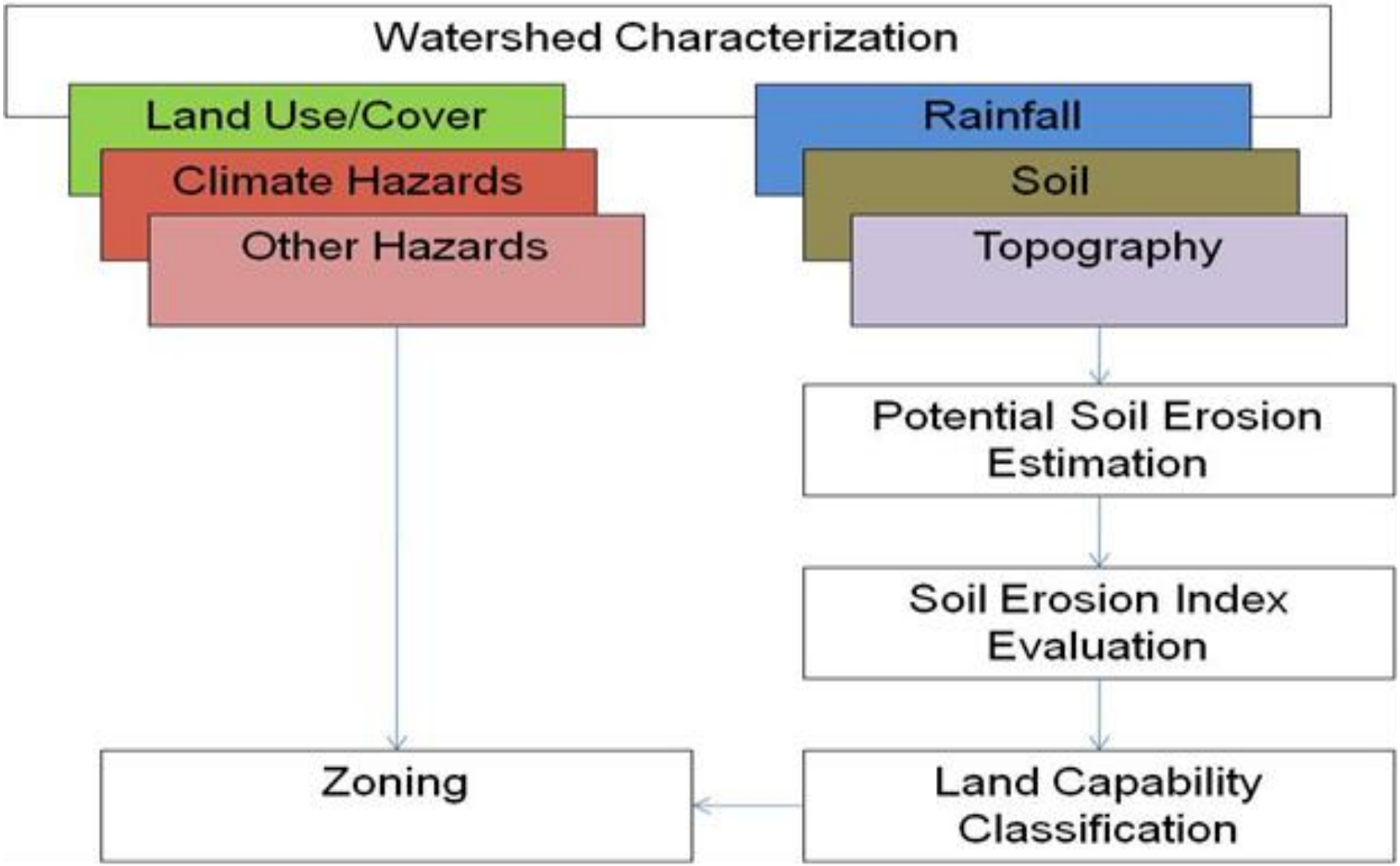
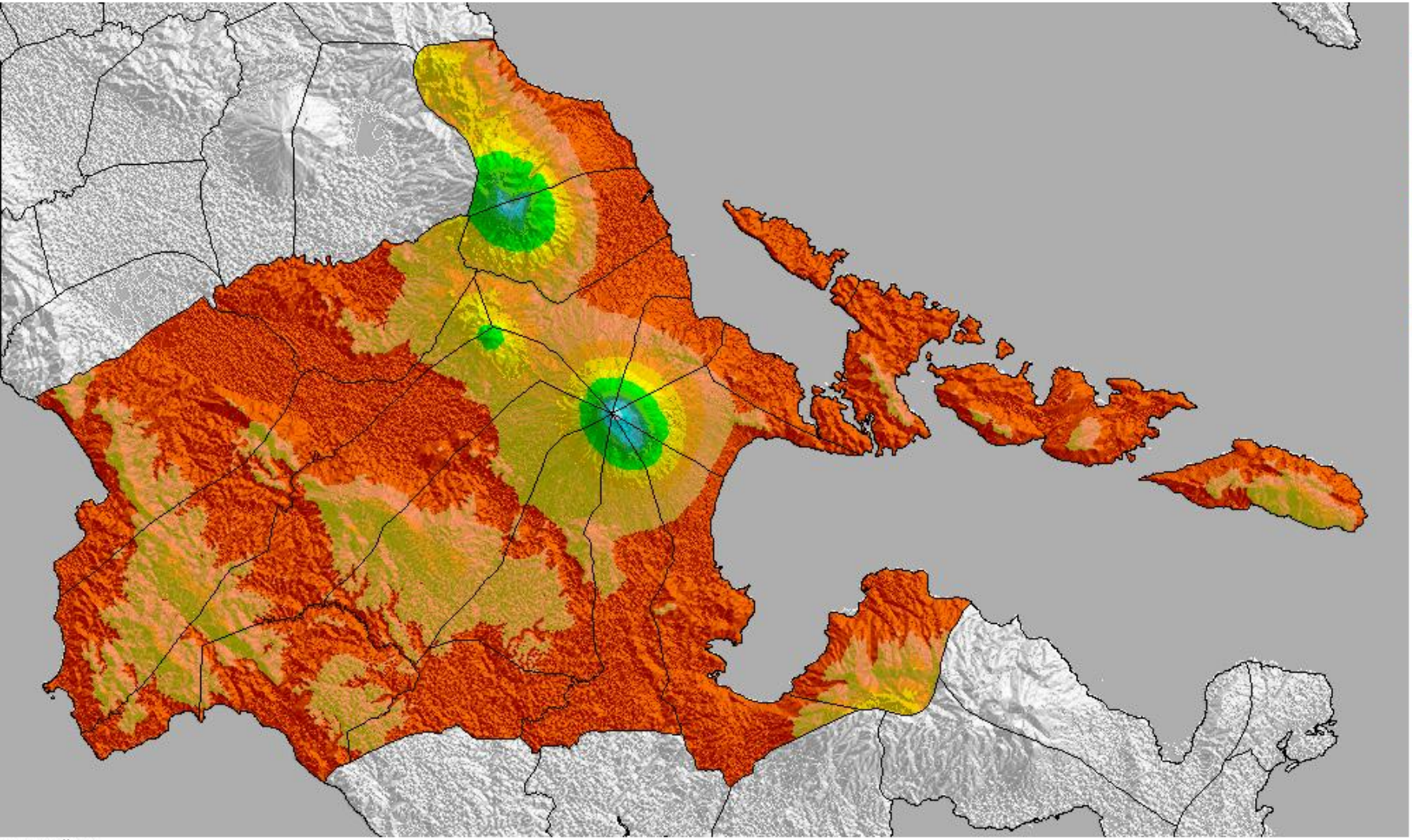
Scientific Basis

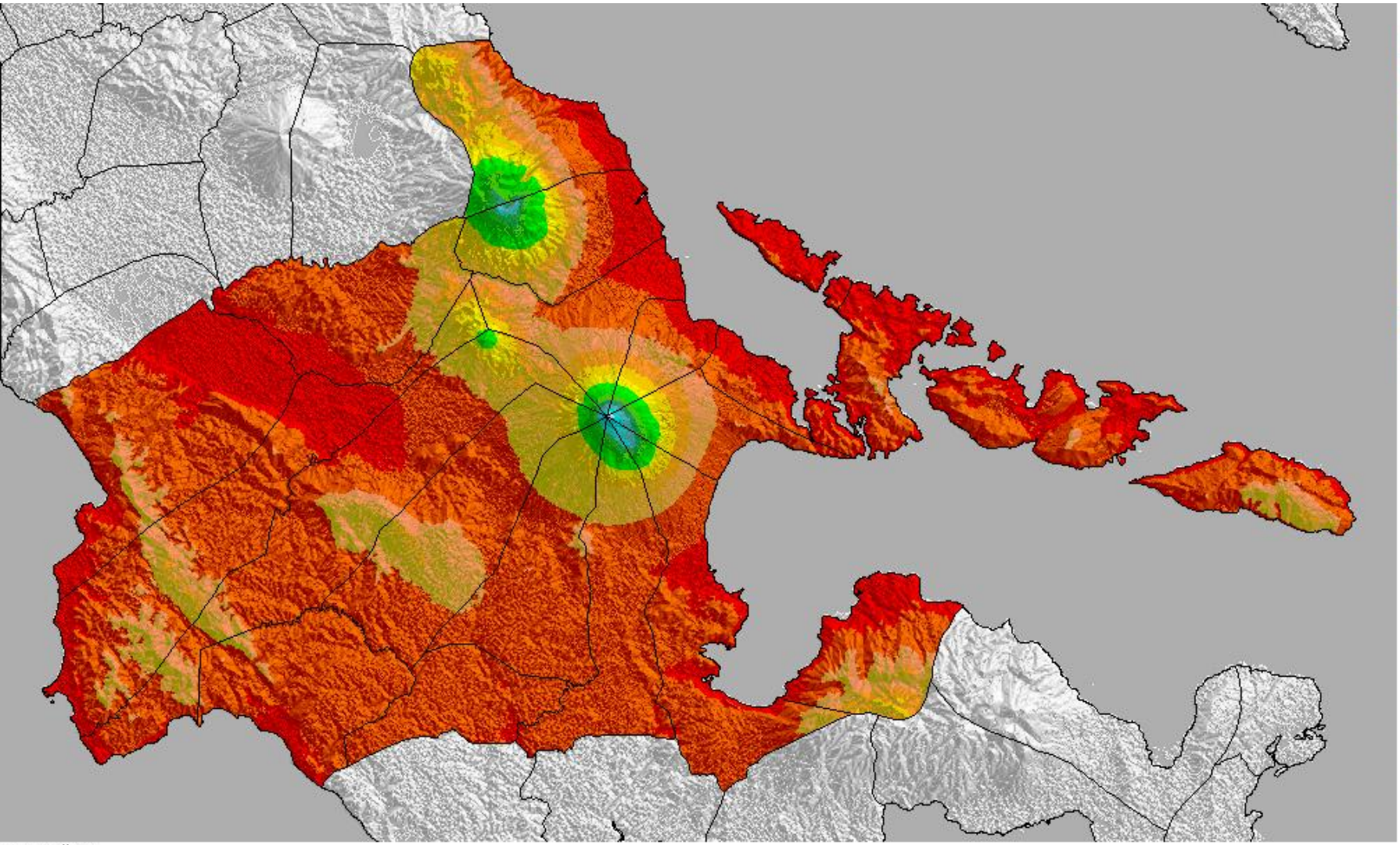


Land Capability Classification Process

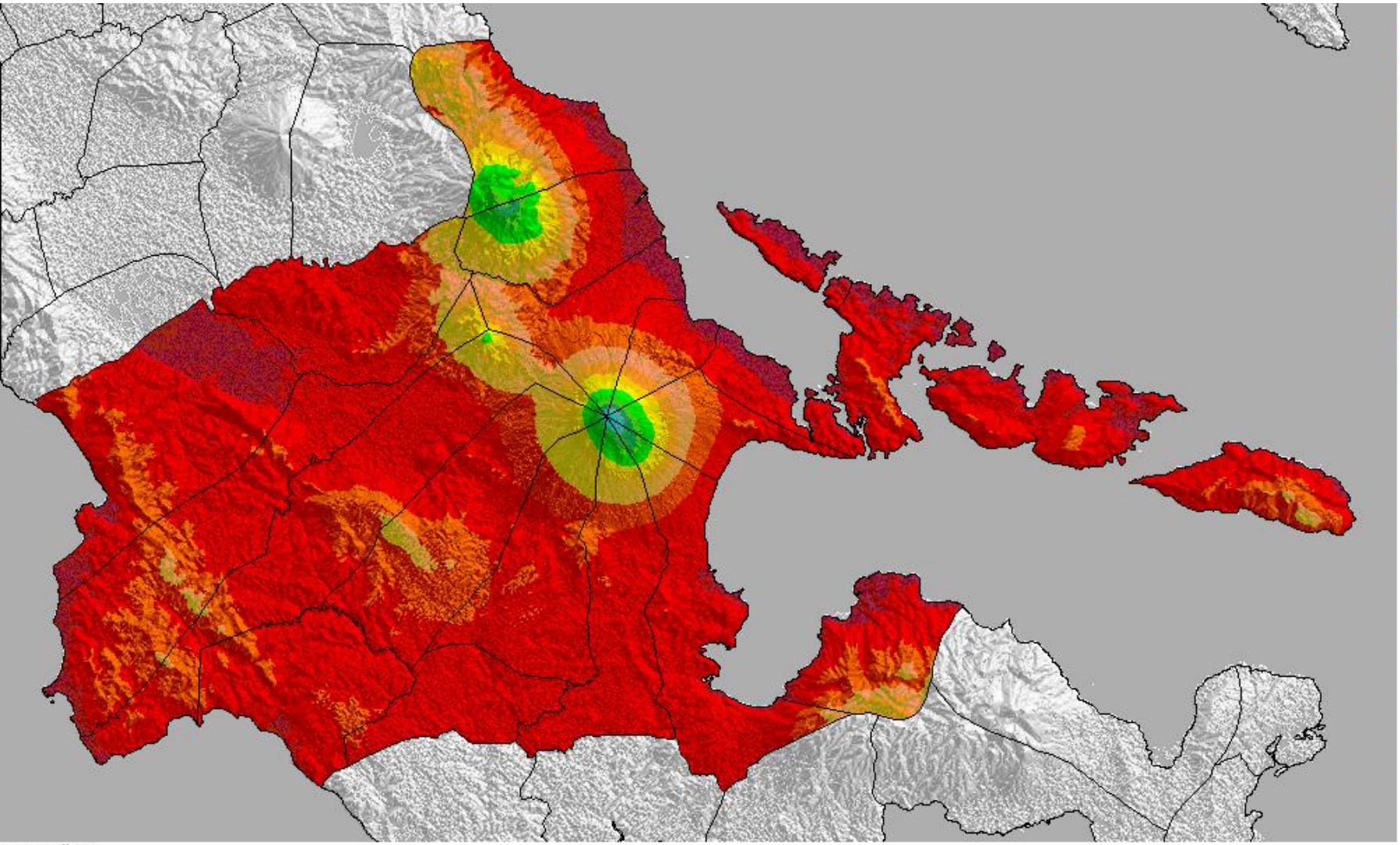




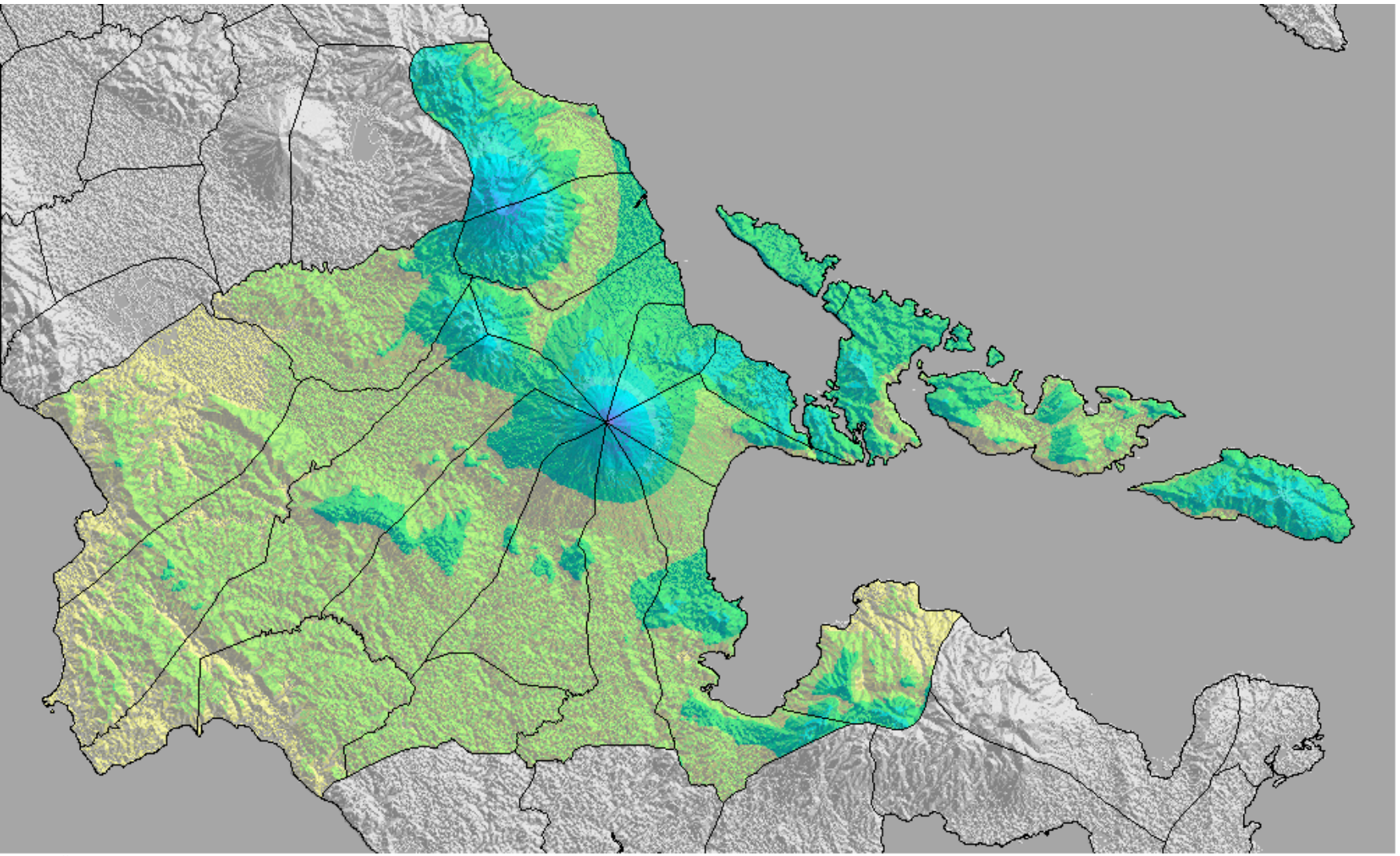
Area: Albay
Model for TMax (°C)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Baseline climate



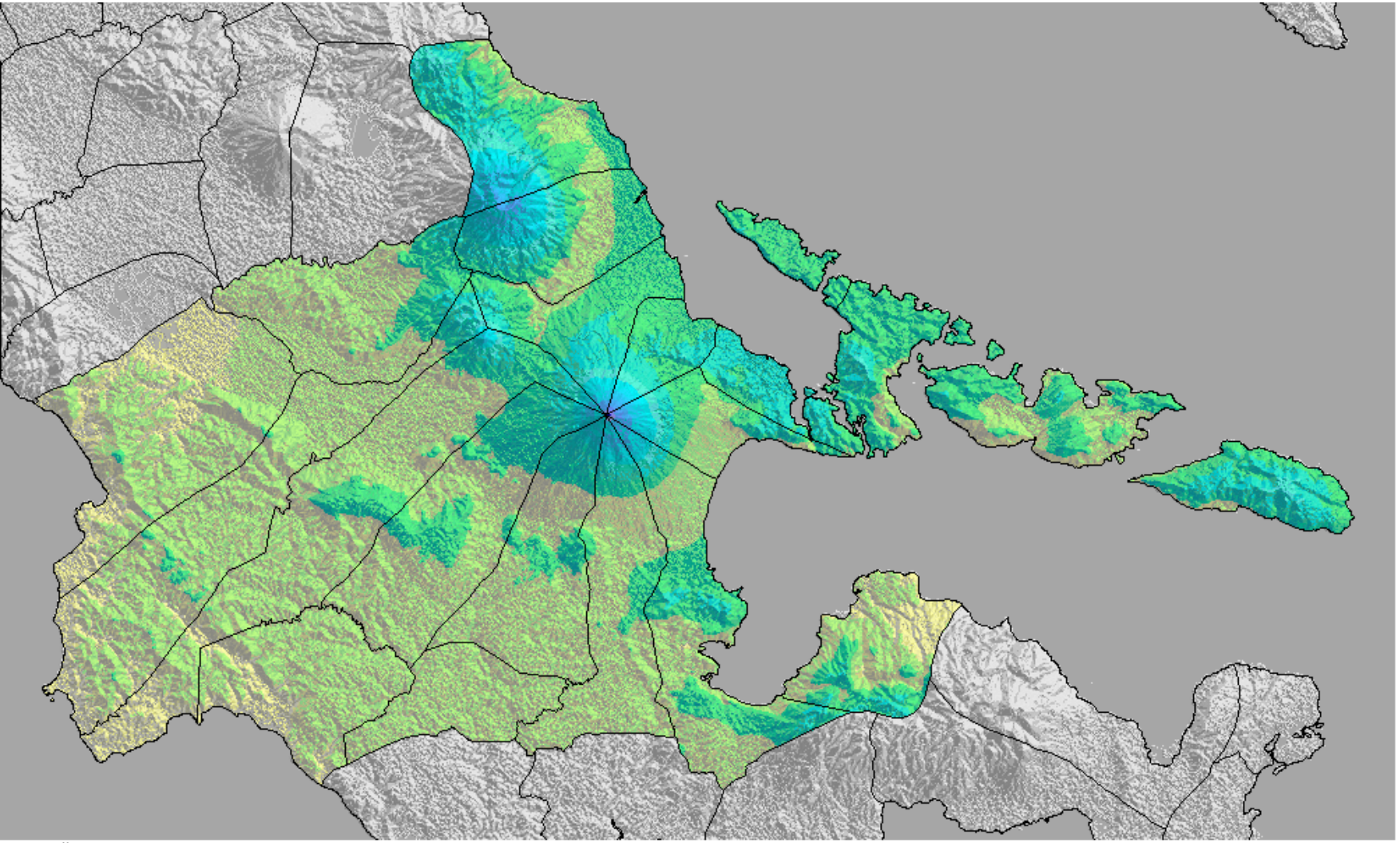
Area: Albay
Model for TMax: (°C)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Scenario generation method: Ensemble
Scenario year: 2020
Climate sensitivity: High
GCM Pattern: Ensemble: 21-GCM Albay
Emission scenario:



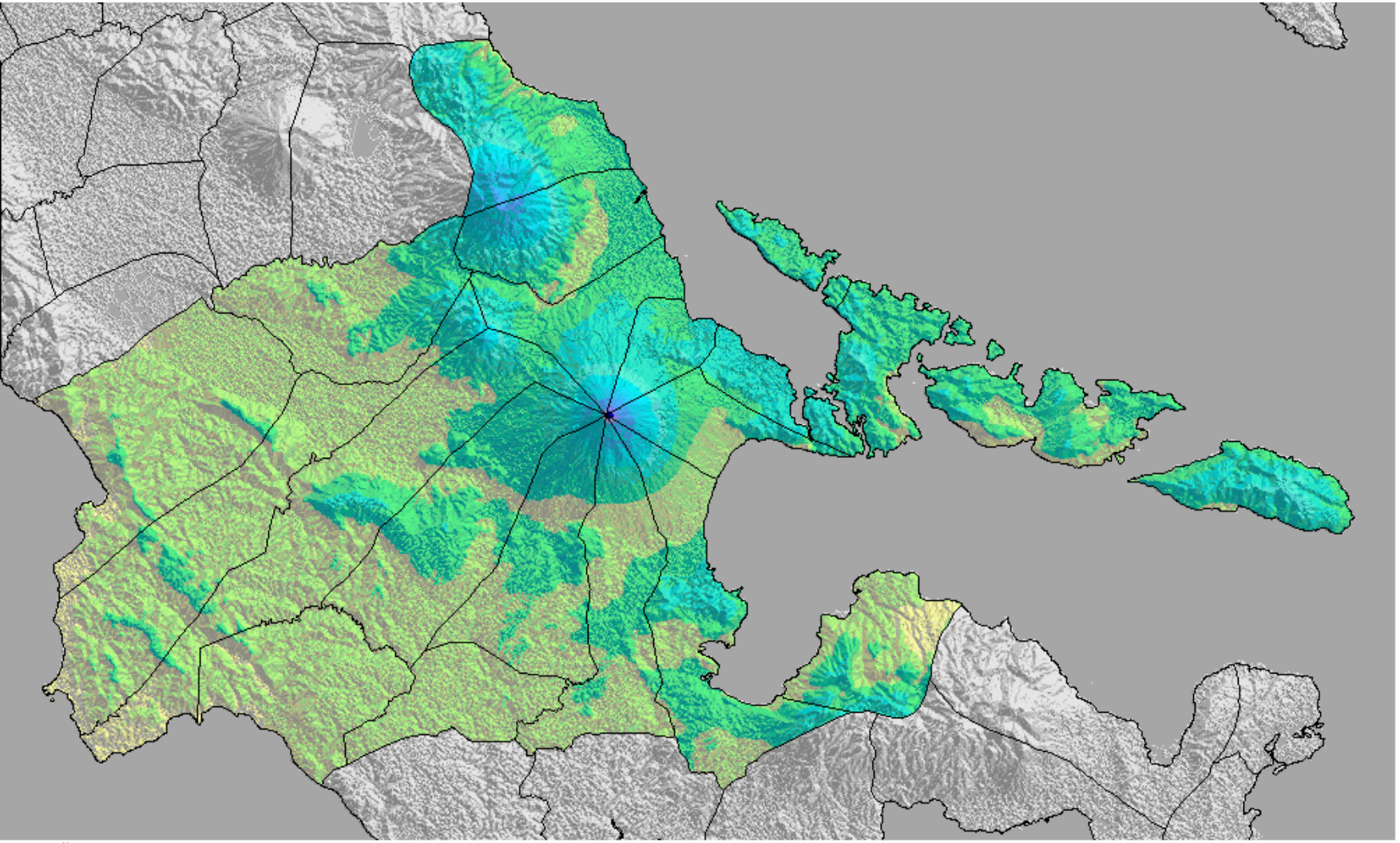
Area: Albay
Model for TMax: (°C)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Scenario generation method: Ensemble
Scenario year: 2050
Climate sensitivity: High
GCM Pattern: Ensemble: 21-GCM Albay
Emission scenario:



Area: Albay
Model for Precip (mm)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Baseline climate

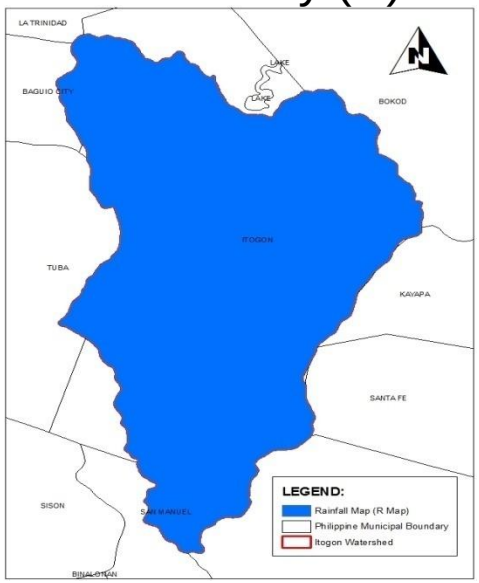


Area: Albay
Model for Precip: (mm)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Scenario generation method: Ensemble
Scenario year: 2020
Climate sensitivity: High
GCM Pattern: Ensemble: 21-GCM Albay
Emission scenario:



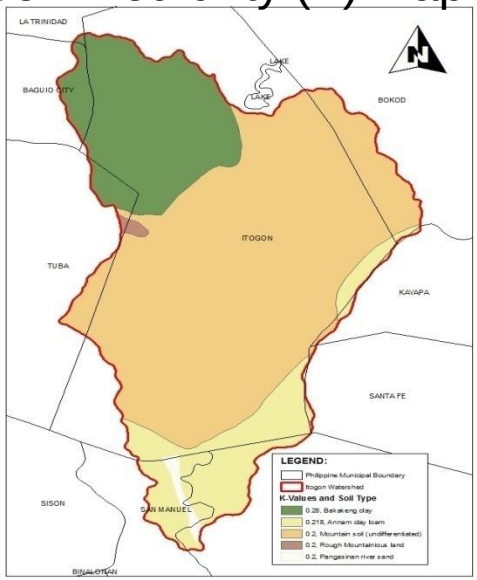
Area: Albay
Model for Precip: (mm)
Selected Month: 1 2 3 4 5 6 7 8 9 10 11 12
Scenario generation method: Ensemble
Scenario year: 2050
Climate sensitivity: High
GCM Pattern: Ensemble: 21-GCM Albay
Emission scenario:

Rainfall Erosivity (R) Map



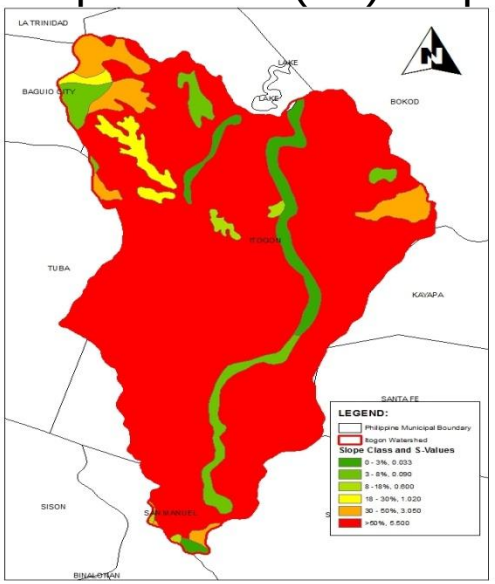
X

Soil Erodibility (K) Map

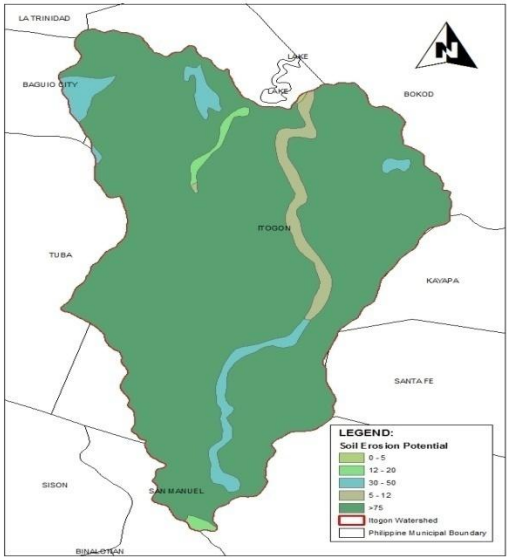


X

Slope Factor (LS) Map

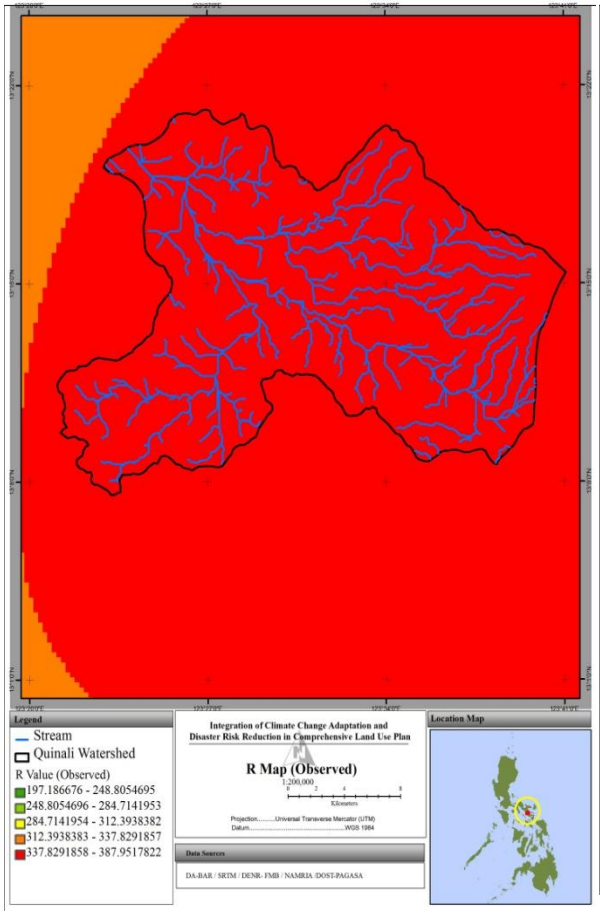


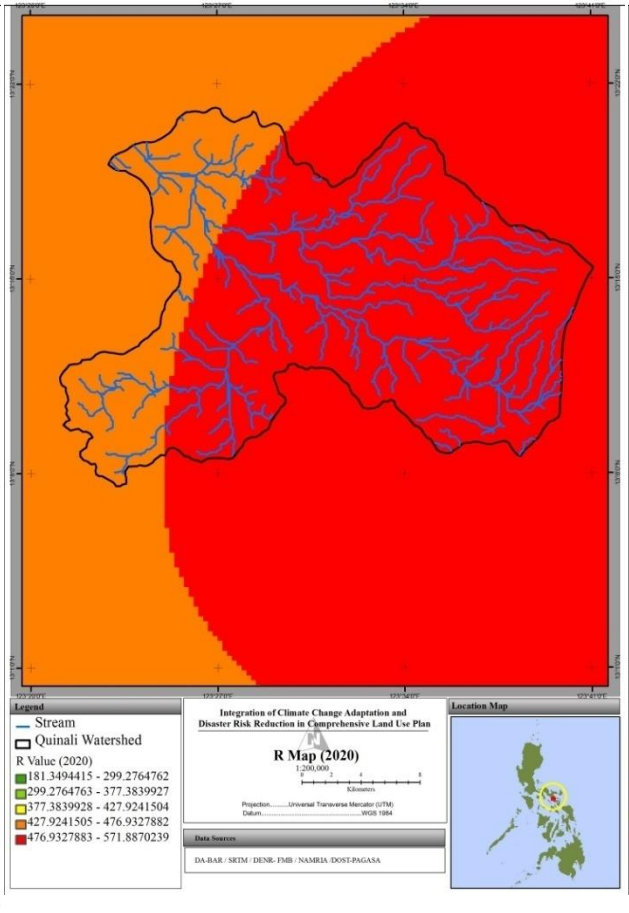
R K S

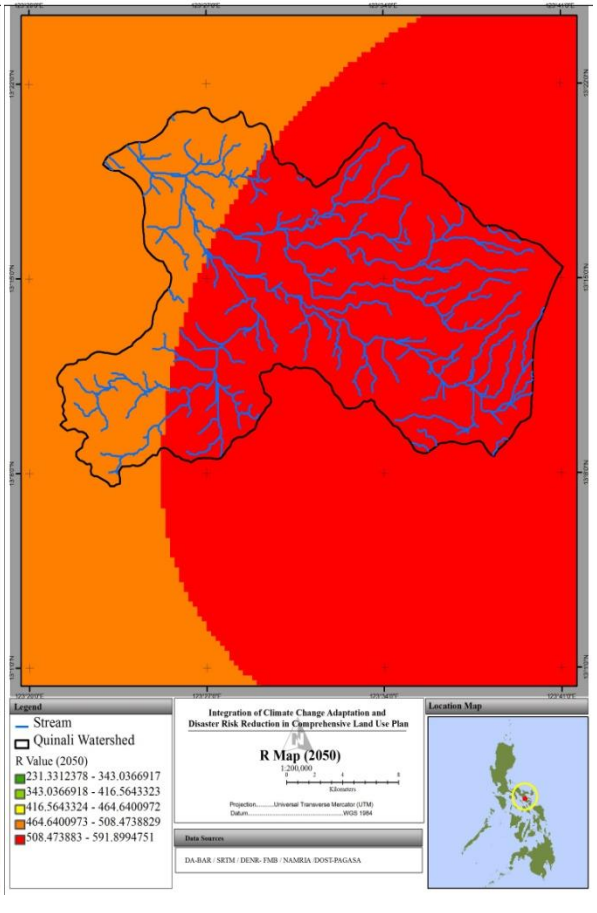


Potential Soil Erosion

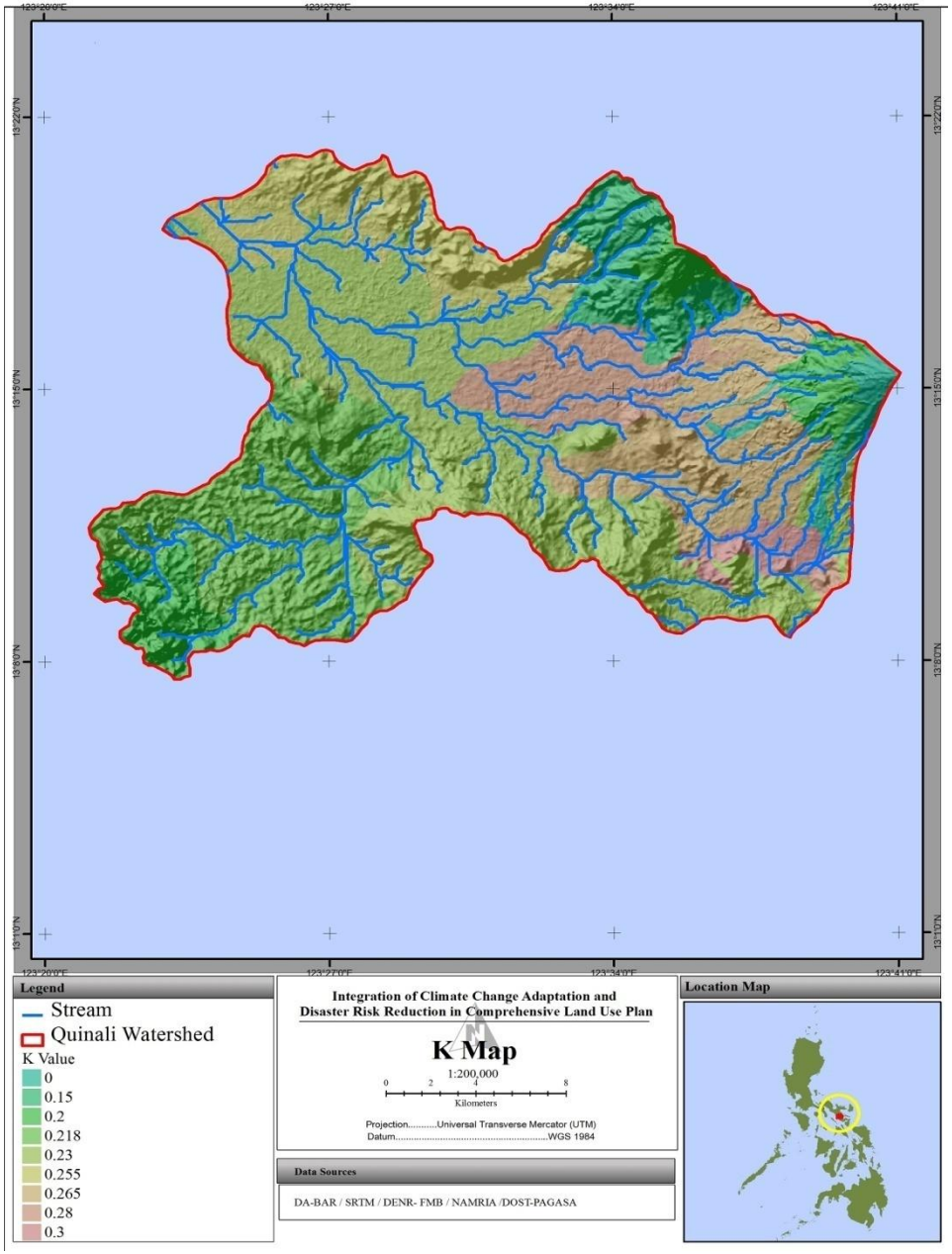
Rainfall Erosivity Map



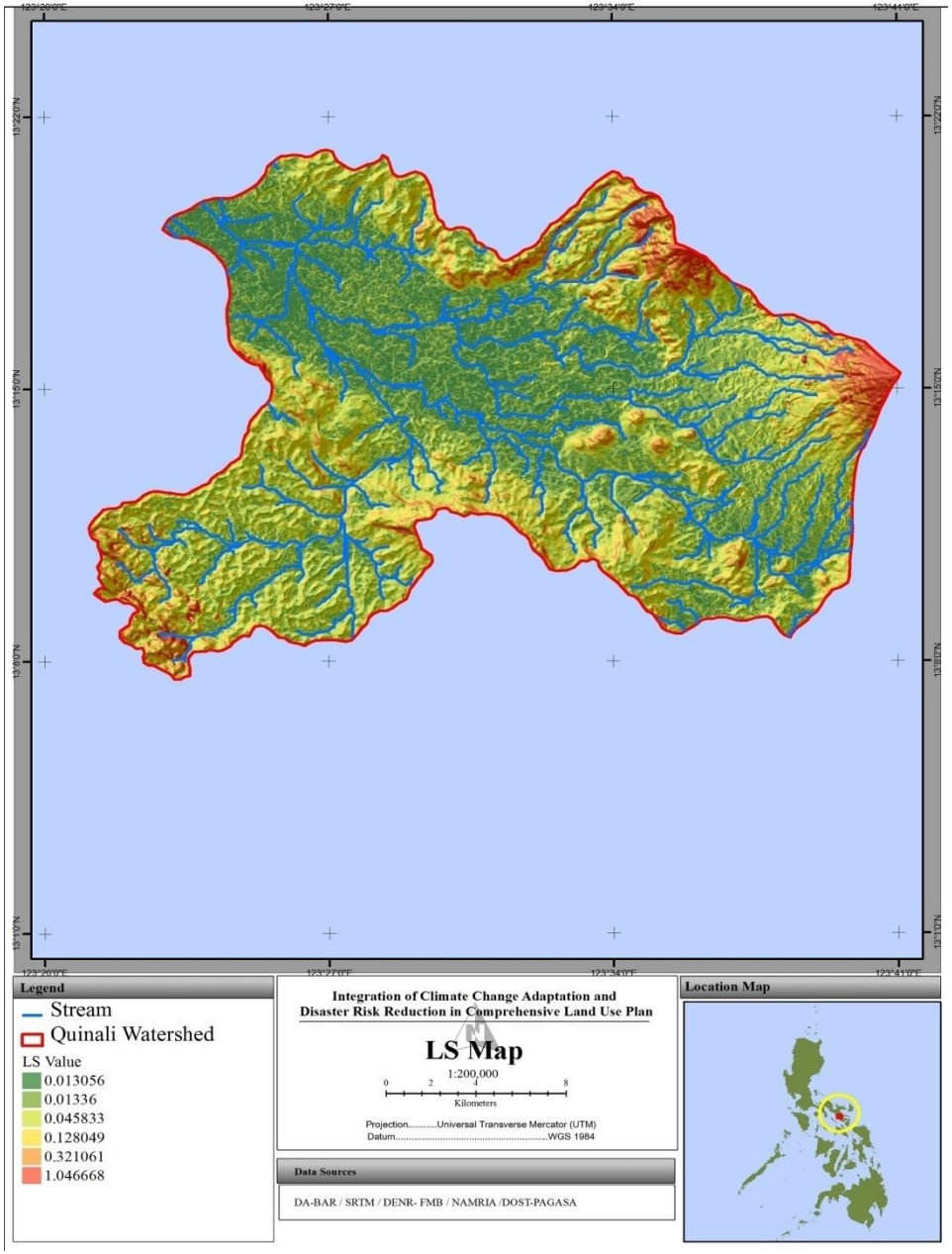




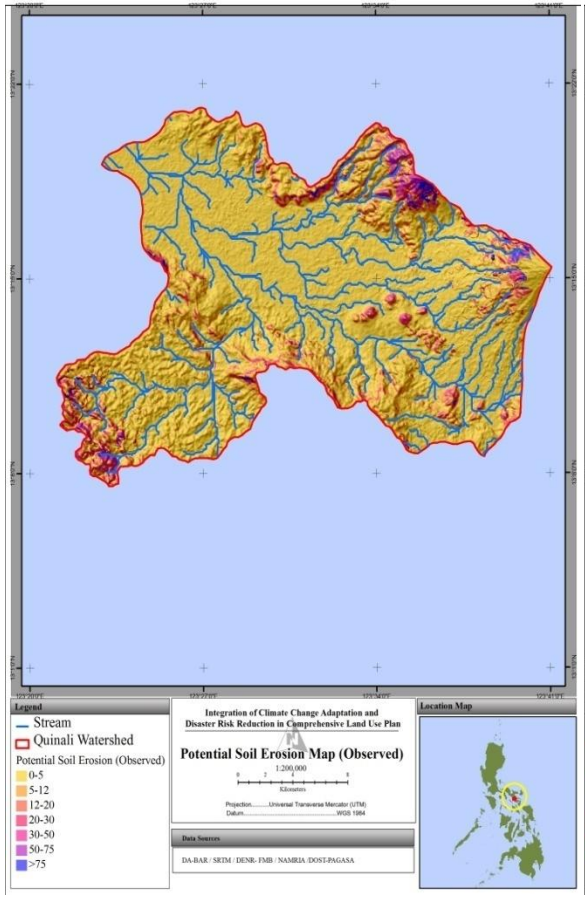
Soil Erodibility (K) Map

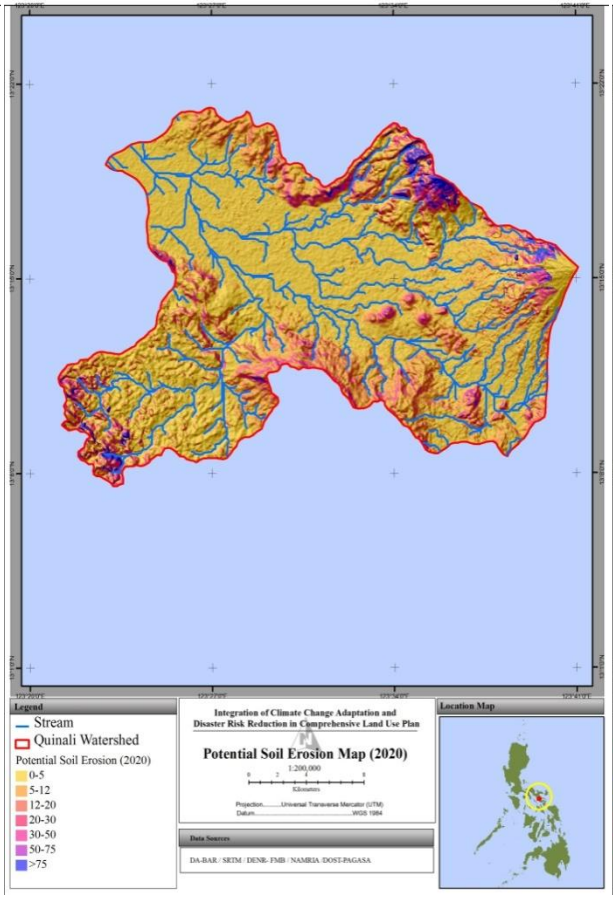


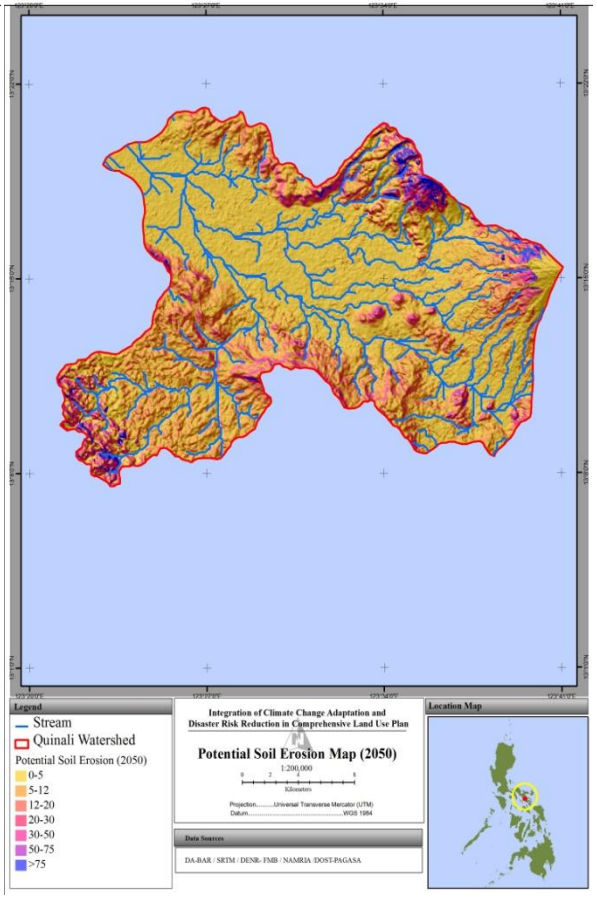
Slope Length and Gradient (LS) Map



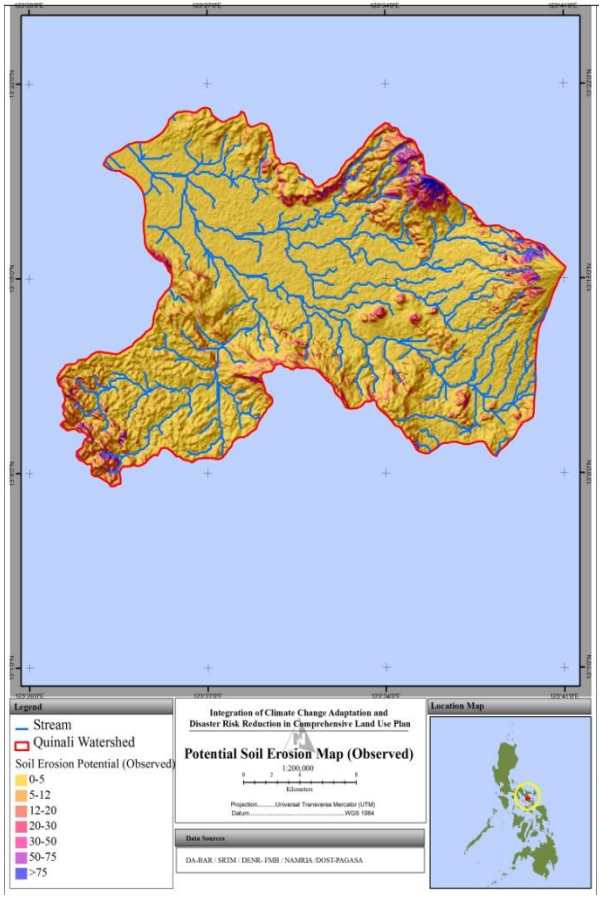
Soil Erosion Potential (SEP) Map (PRECIS)

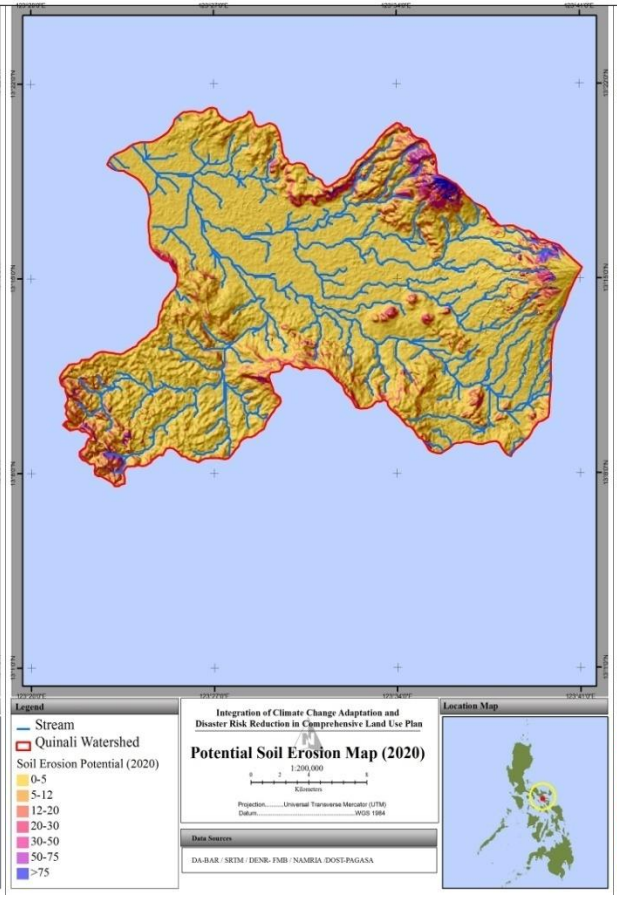


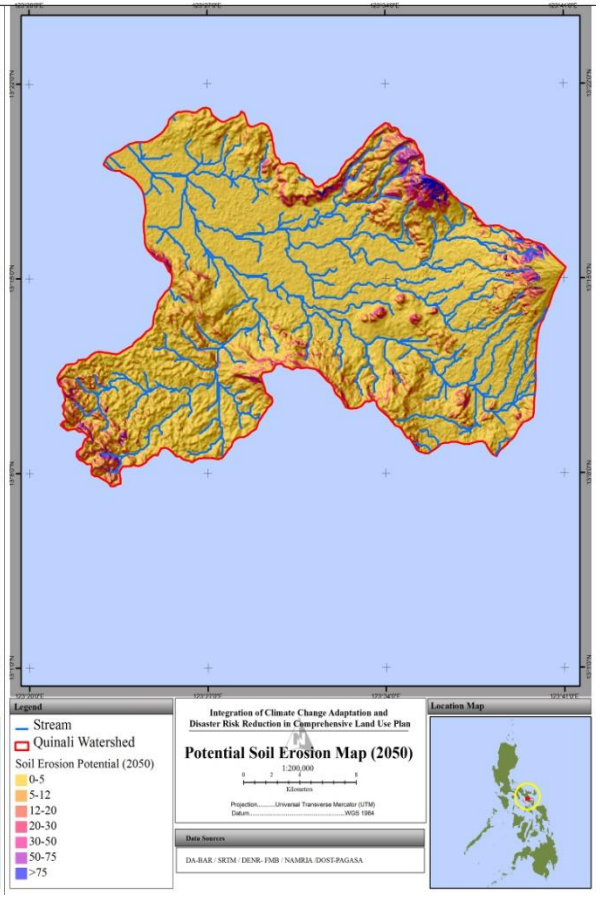




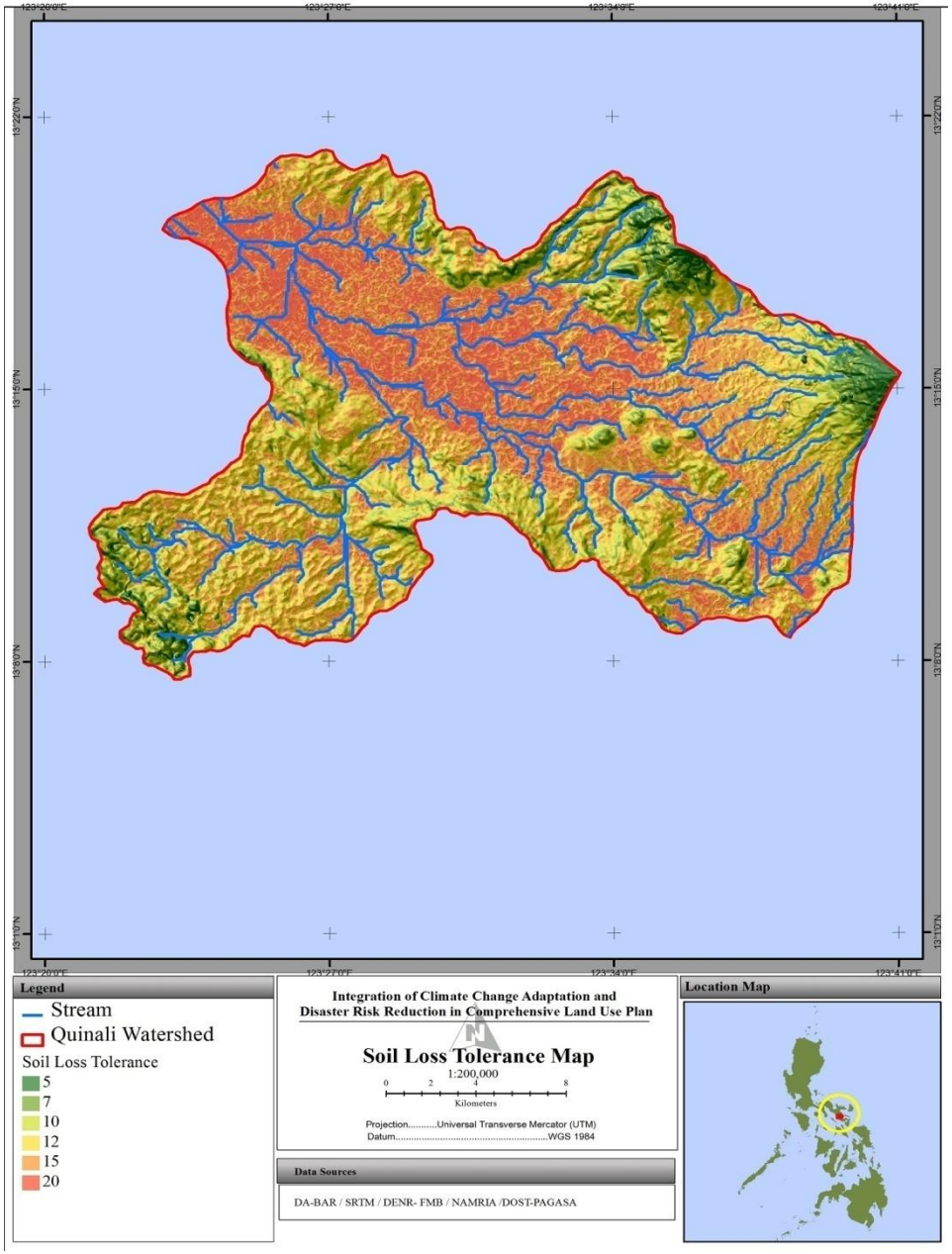
Soil Erosion Potential (SEP) Map (SimCLIM)



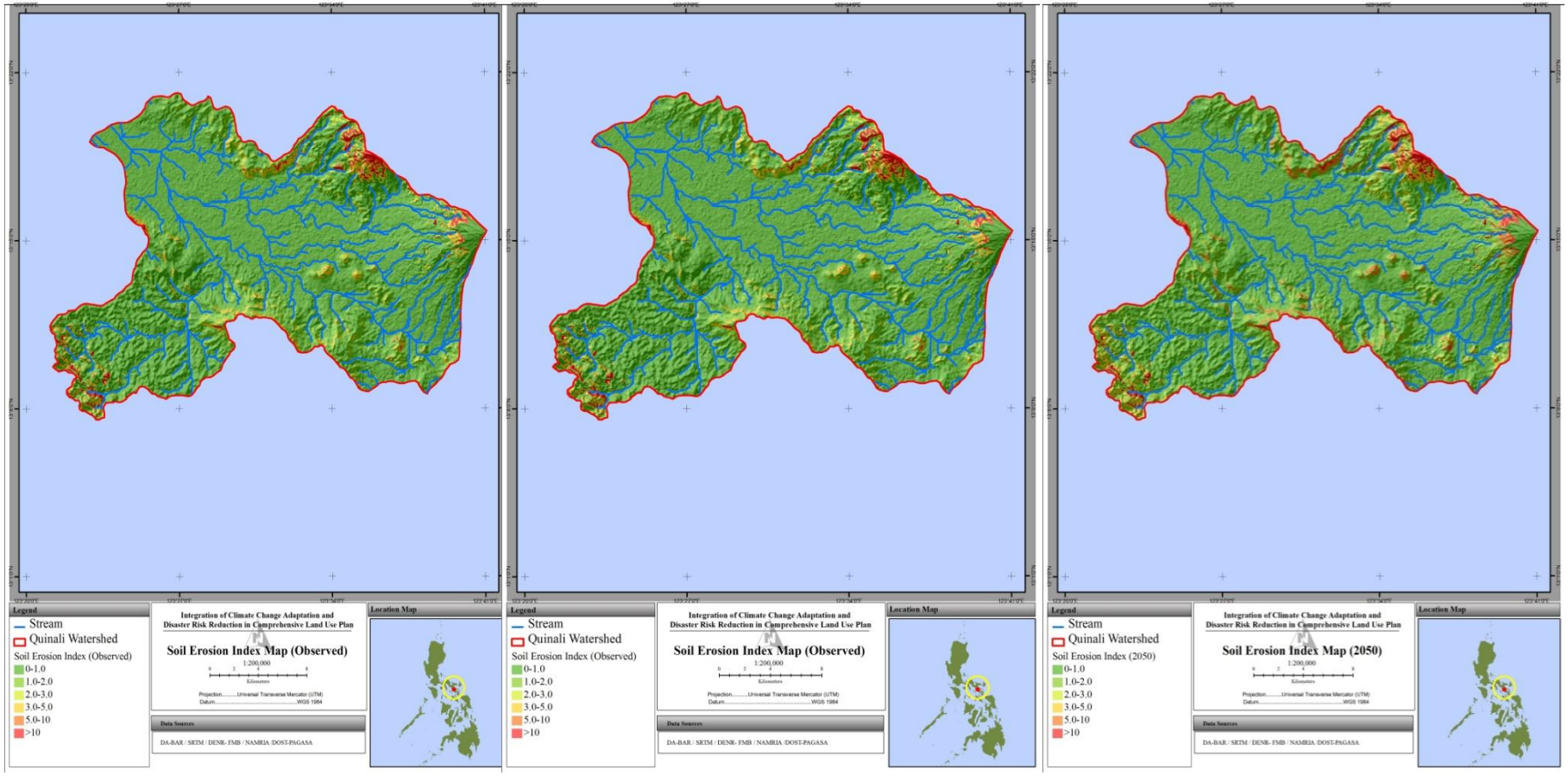




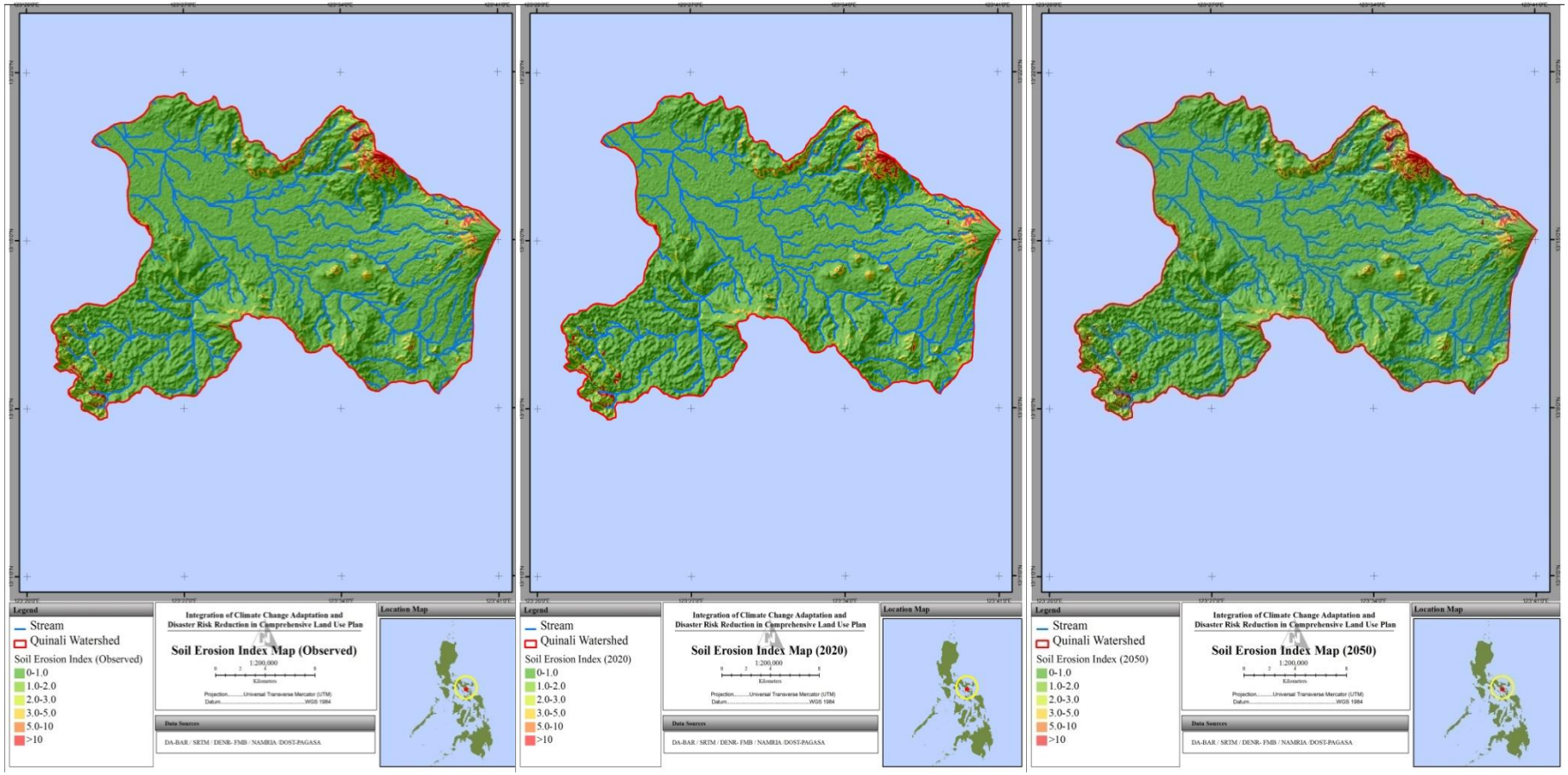
Soil Loss Tolerance Limit (SLT) Map



Soil Erosion Index (SEI) Map (PRECIS)



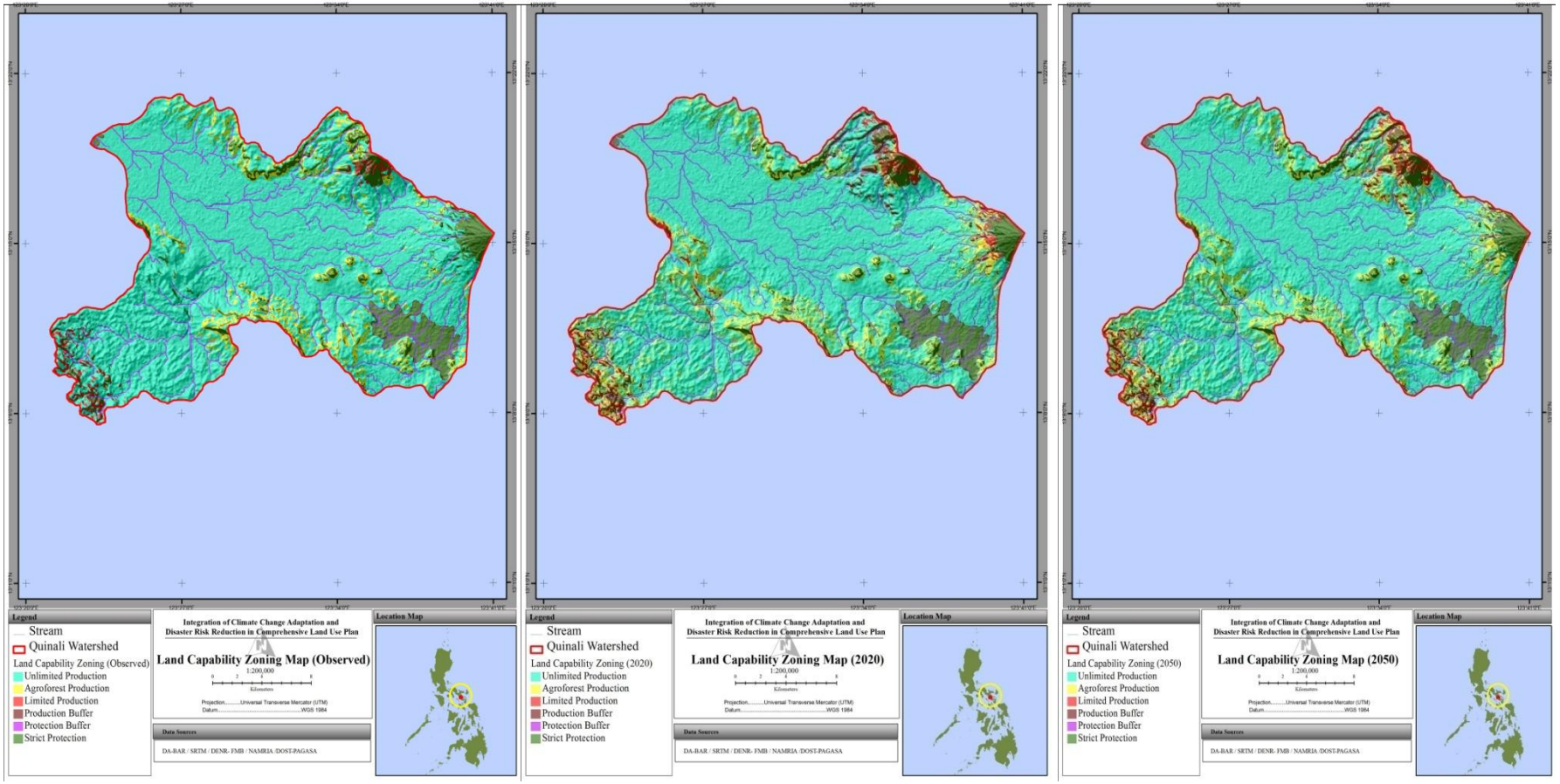
Soil Erosion Index (SEI) Map (SimCLIM)



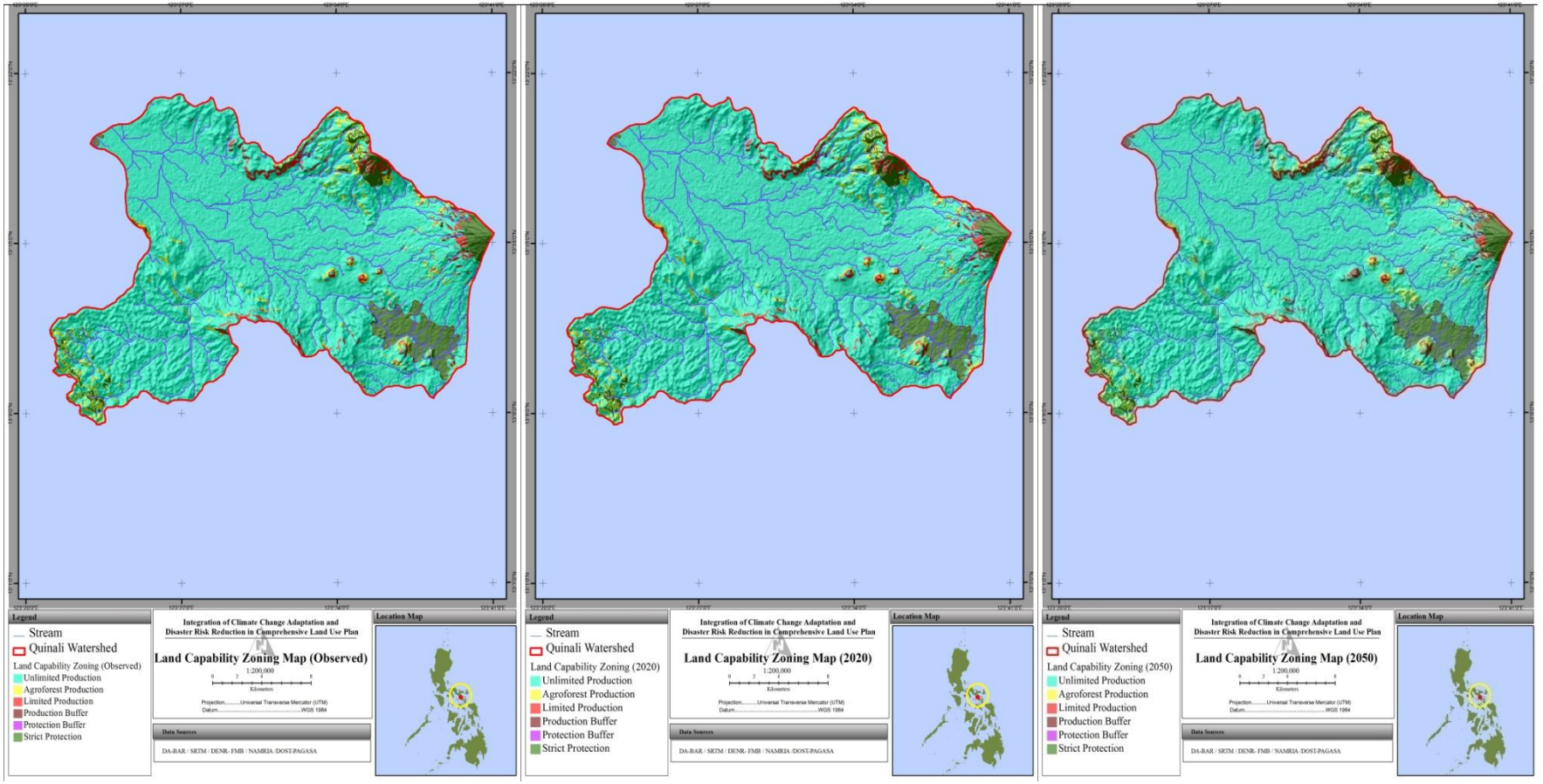
Land Capability Classification Criteria

Class	Land Use Zone	SEI	Indicative Land Uses
I	**PROTECTION AREAS**		
Ia	***Strict Protection*** All remaining natural forests, all areas with high erosion potential and slope >50%, all areas (including grass and brush lands) known to support important wildlife and with high value for biodiversity conservation, all other areas with SEI > 5	>5	Strict protection, limited collection of ornamental plants, herbs, vines, fruits and other non-timber products may be allowed
Ib	***Protection Buffer*** All areas within 40 m of stream banks, all areas within 50 m of major watershed divides		Permanent crops (fruit trees, bamboo), harvesting of fruits and bamboo shoots and culms will be allowed but no harvesting of trees will be allowed
II	**PRODUCTION AREAS**		
IIa	***Unlimited Production*** Grasslands and brushlands; built up and cultivated areas	0-1	Timber and fruit tree plantations, agriculture and agroforestry can be allowed with suitable soil and water conservation measures, settlement can be allowed
IIb	***Agroforest Production*** Grasslands and brushlands; built up and cultivated areas	1-3	Multistory timber and fruit tree plantations, agroforestry can be allowed with suitable soil and water conservation measures
IIc	***Limited Production*** Grasslands and brushlands; built up and cultivated areas	3-5	Multistory timber and fruit tree plantations
IId	***Production Buffer*** Areas within 50 m of remaining natural forest line		Permanent crops (fruit trees, bamboo) and compatible uses. Fuel wood and timber tree plantations can be allowed within 20-50 m band from the forest line

Land Capability Zone Map (PRECIS)



Land Capability Zone Map (SimCLIM)

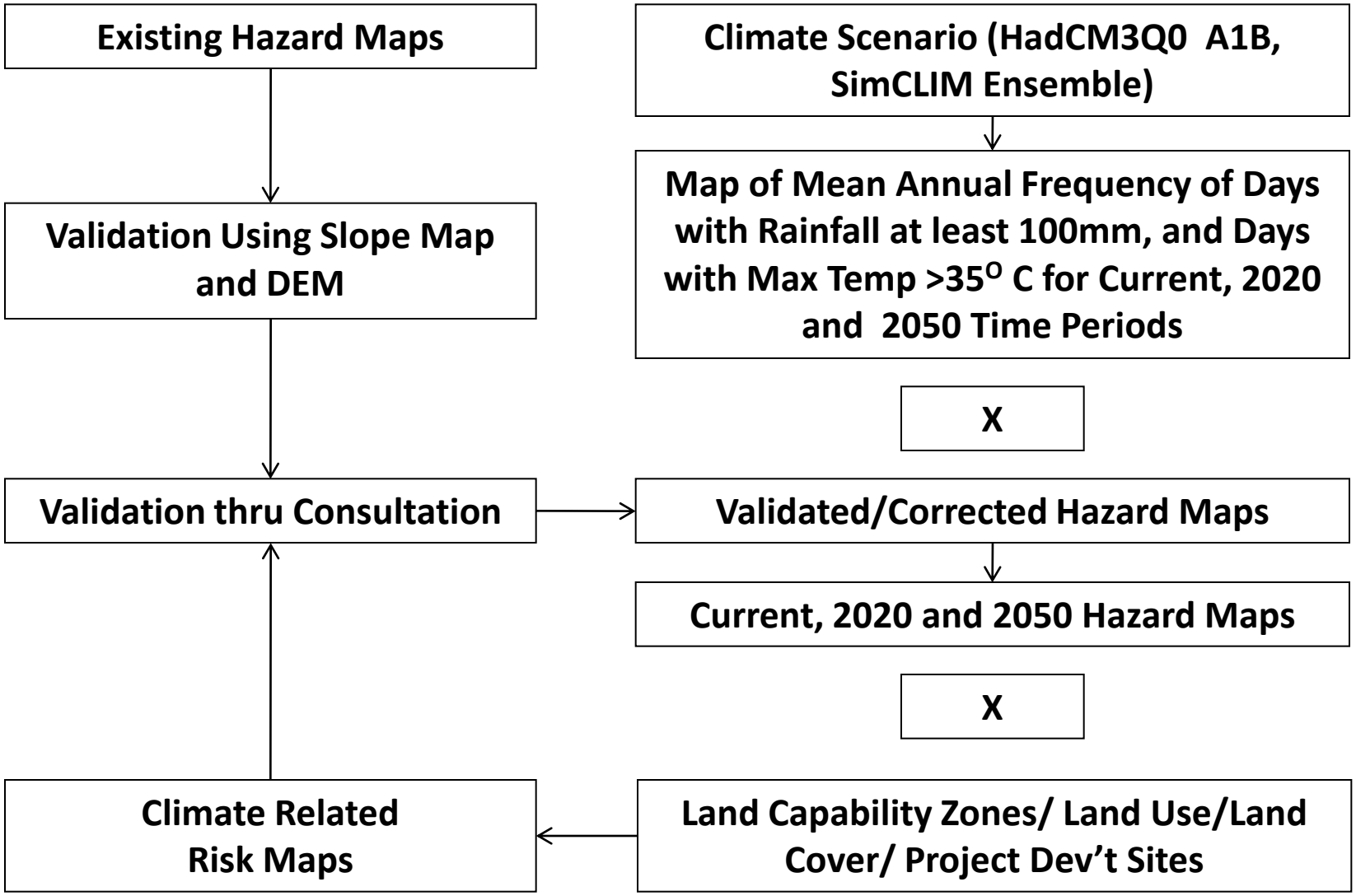


Land Capability Zoning (Observed)	MUNICIPALITY							
	Bato	Camalig	Guinobatan	Libon	Ligao City	Oas	Polangui	Tabaco City
Unlimited Production	3	2281	6329	5030	10584	10848	5523	
Agroforest Production		260	930	99	1101	267	827	
Limited Production				96	146	487		
Production Buffer		87	70	11	34			
Protection Buffer	2	470	726	505	1147	951	546	6
Strict Protection		1113	1358	145	814	415	341	5
TOTAL	***4***	***4211***	***9414***	***5886***	***13826***	***12966***	***7237***	***11***

Land Capability Zoning (2020)	MUNICIPALITY							
	Bato	Camalig	Guinobatan	Libon	Ligao City	Oas	Polangui	Tabaco City
Unlimited Production	3	2140	6067	4615	10305	9381	5523	
Agroforest Production		401	1192	514	1251	1505	709	
Limited Production		51	148	171	328	788	117	
Production Buffer		87	70	11	34			
Protection Buffer	2	470	726	505	1147	951	546	6
Strict Protection		1063	1210	70	760	341	341	5
TOTAL	***4***	***4211***	***9414***	***5886***	***13826***	***12966***	***7237***	***11***

Land Capability Zoning (2050)	MUNICIPALITY							
	Bato	Camalig	Guinobatan	Libon	Ligao City	Oas	Polangui	Tabaco City
Unlimited Production	3	2140	6067	4615	9966	9119	5424	
Agroforest Production		401	1192	514	1590	1767	808	
Limited Production				96	275	715	117	
Production Buffer		87	70	11	34			
Protection Buffer	2	470	726	505	1147	951	546	6
Strict Protection		1113	1358	145	814	415	341	5
TOTAL	***4***	***4211***	***9414***	***5886***	***13826***	***12966***	***7237***	***11***

Framework



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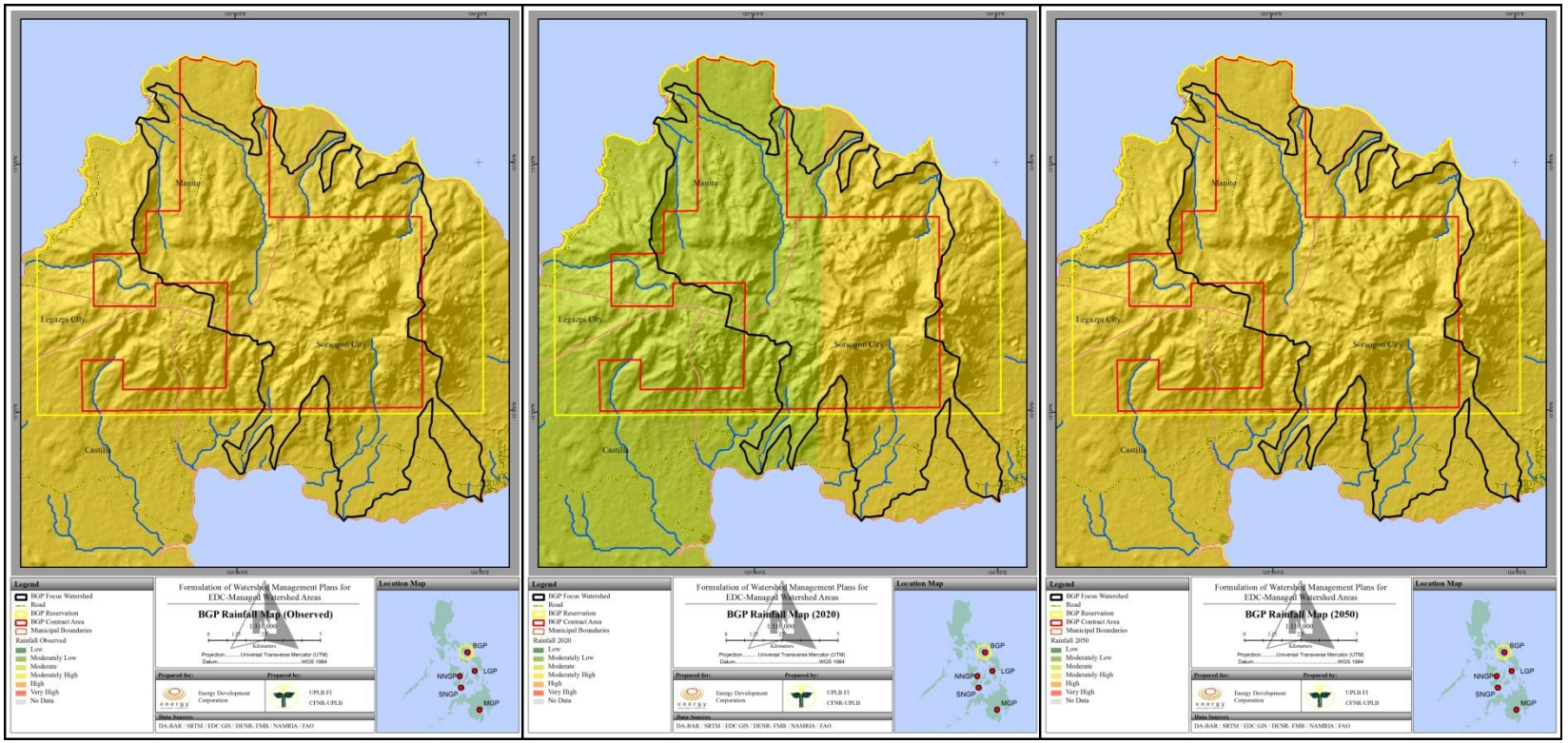
MEAN ANNUAL FREQUENCY OF DAYS WITH RAIN OF AT LEAST 100 mm (Observed, 2020, 2050)



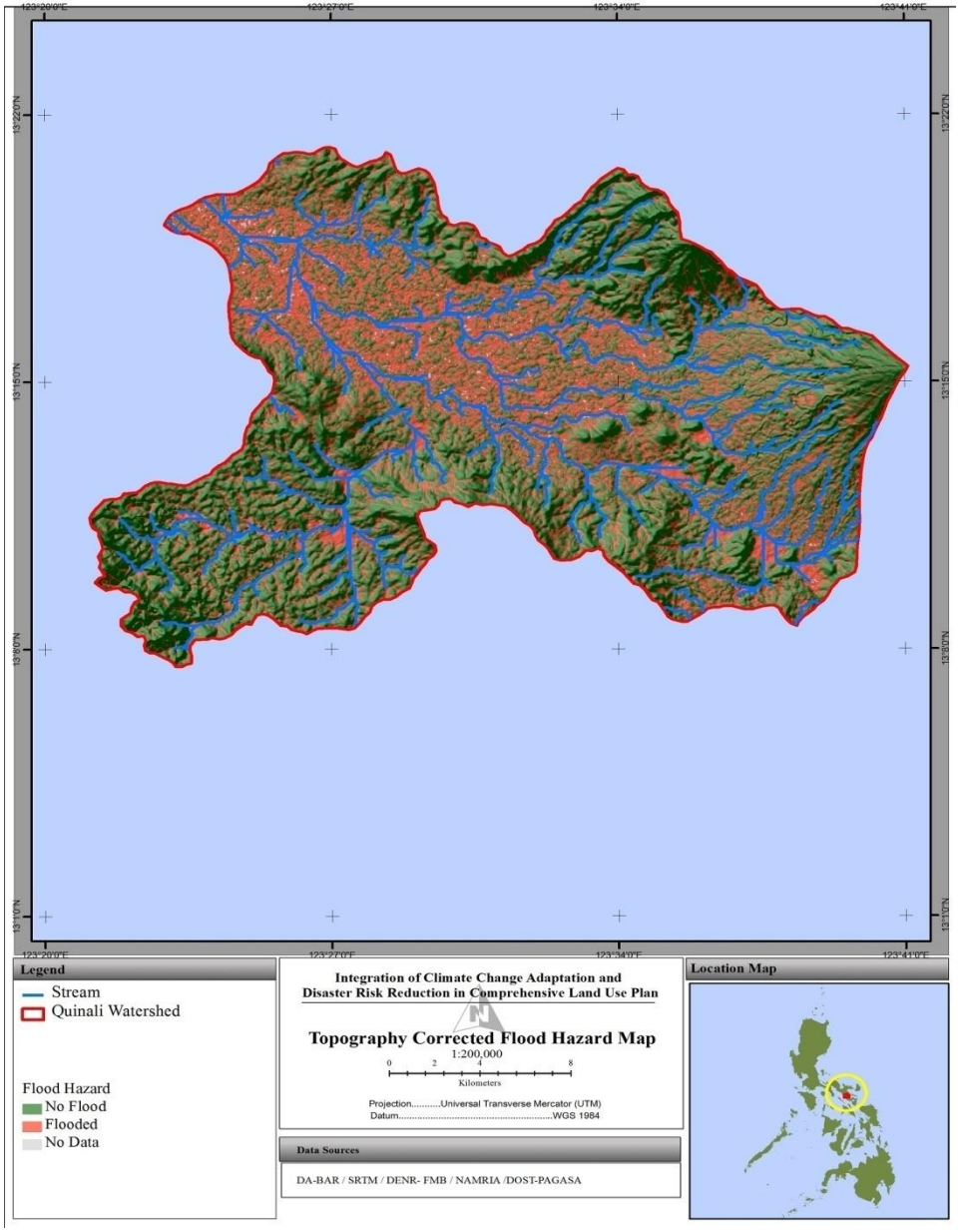
MEAN ANNUAL FREQUENCY OF DAYS WITH RAIN OF AT LEAST 100 mm (Observed, 2020, 2050)

Number of days with at least 100 mm of rain	Nominal Rating
0-1	Low
1-2	Mod Low
2-3	Mod
3-4	Mod High
4-5	High
>5	Very High

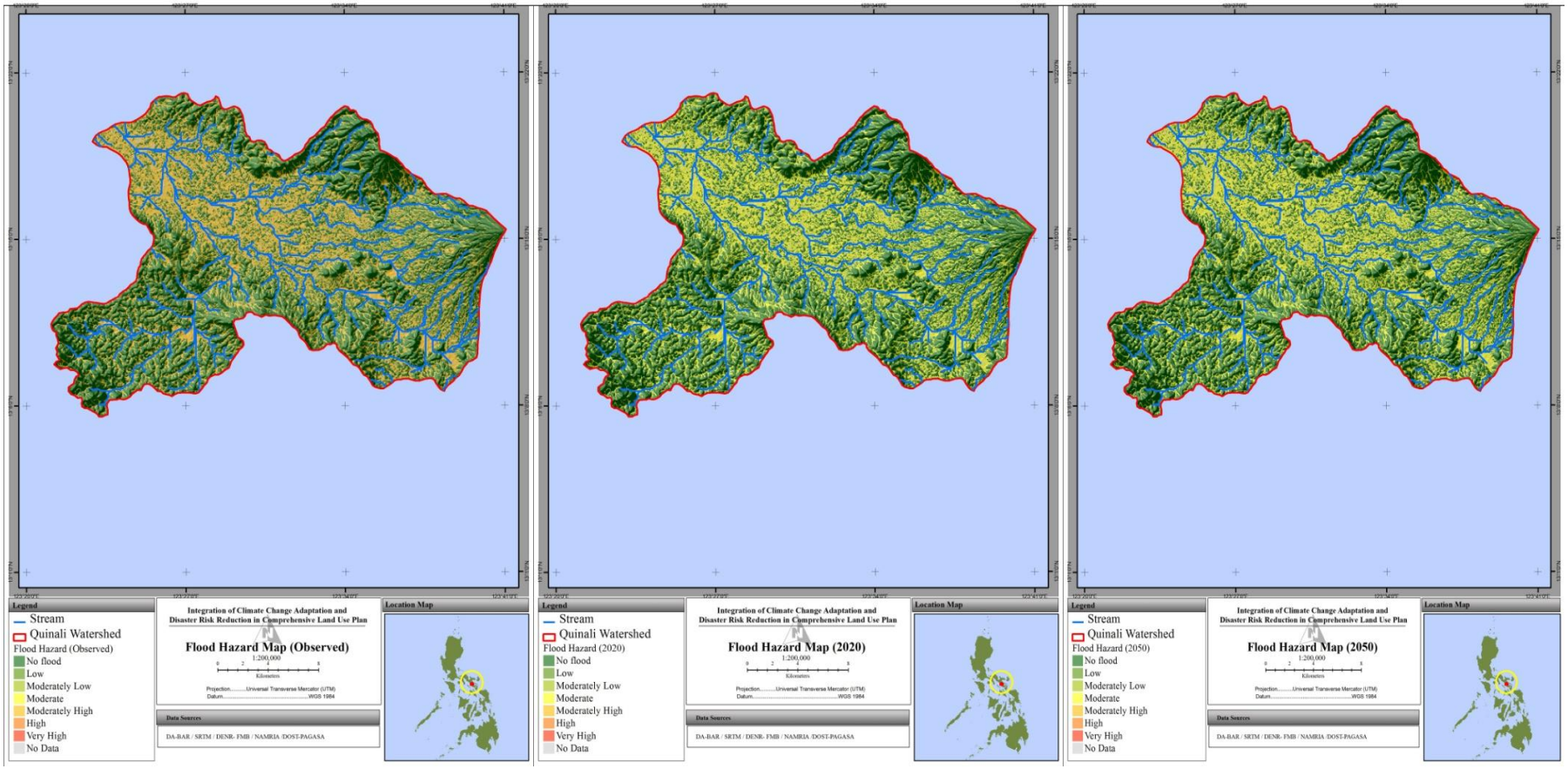
MEAN ANNUAL FREQUENCY OF DAYS WITH RAIN OF AT LEAST 100 mm (Observed, 2020, 2050)

Mean Annual Freq of Days with Rain at least 100mm (observed, 2020 and 2050)	DEM Adjusted Flood Hazard Map	
	Flooded	Not Flooded
Low	Low	None
Mod Low	Mod Low	None
M od	Mod	None
Mod High	Mod High	None
High	High	None
Very High	Very High	None

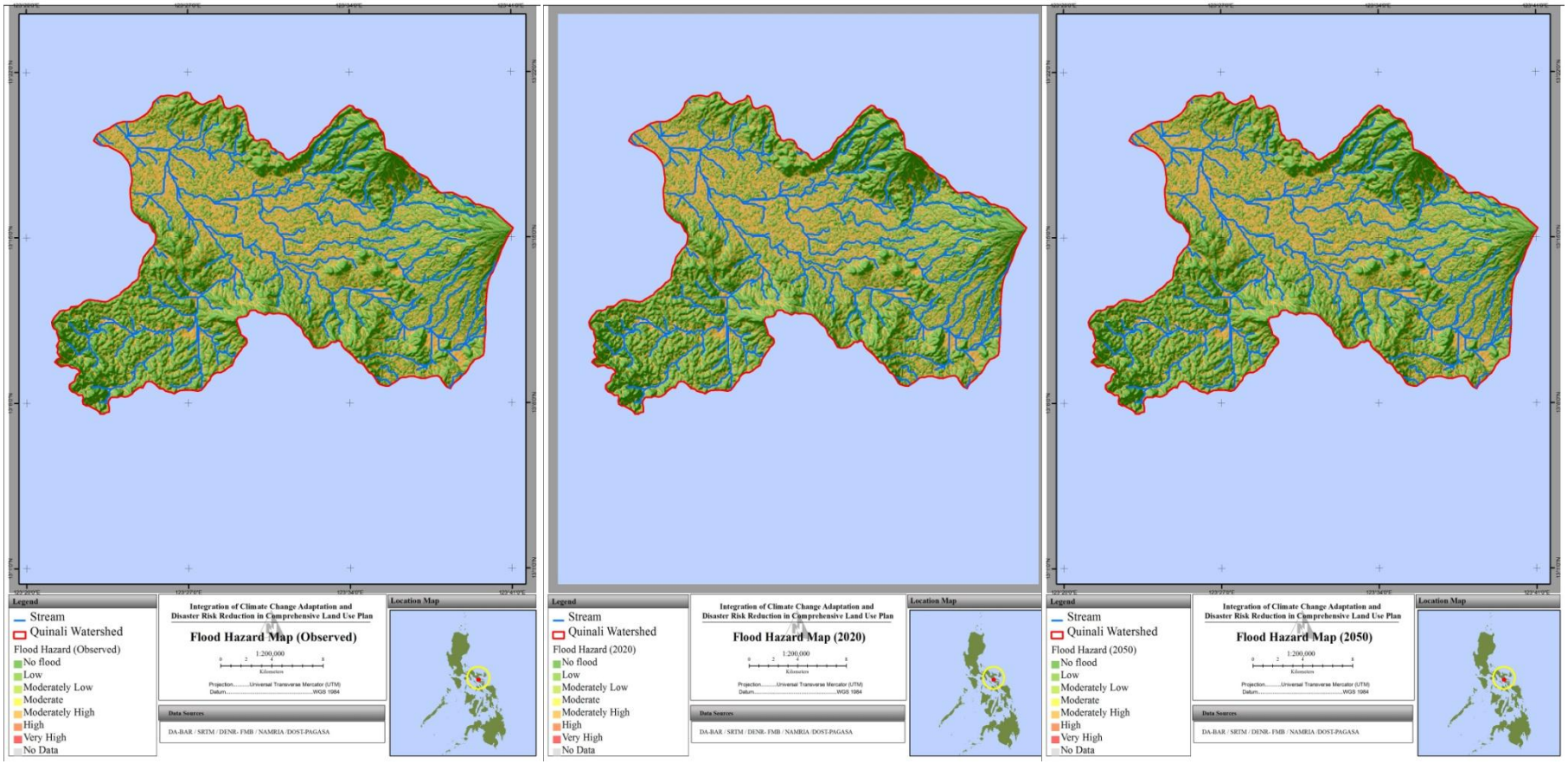
Topography Corrected Flood Hazard Maps



Flood Hazard Map (PRECIS)



Flood Hazard Map (SimCLIM)



Flood Hazard Map

Municipality	Flood Hazard		
	Moderate		Moderately High
	2020	2050	OBS
Bato	3	3	3
Bato Lake	5	5	5
Camalig	1725	1725	1725
Guinobatan	3416	3416	3416
Libon	3101	3101	3101
Ligao City	5649	5649	5649
Oas	4998	4998	4998
Polangui	2980	2980	2980
Tabaco City	0	0	0
TOTAL	*21876*	*21876*	*21876*

Flood Hazard Map

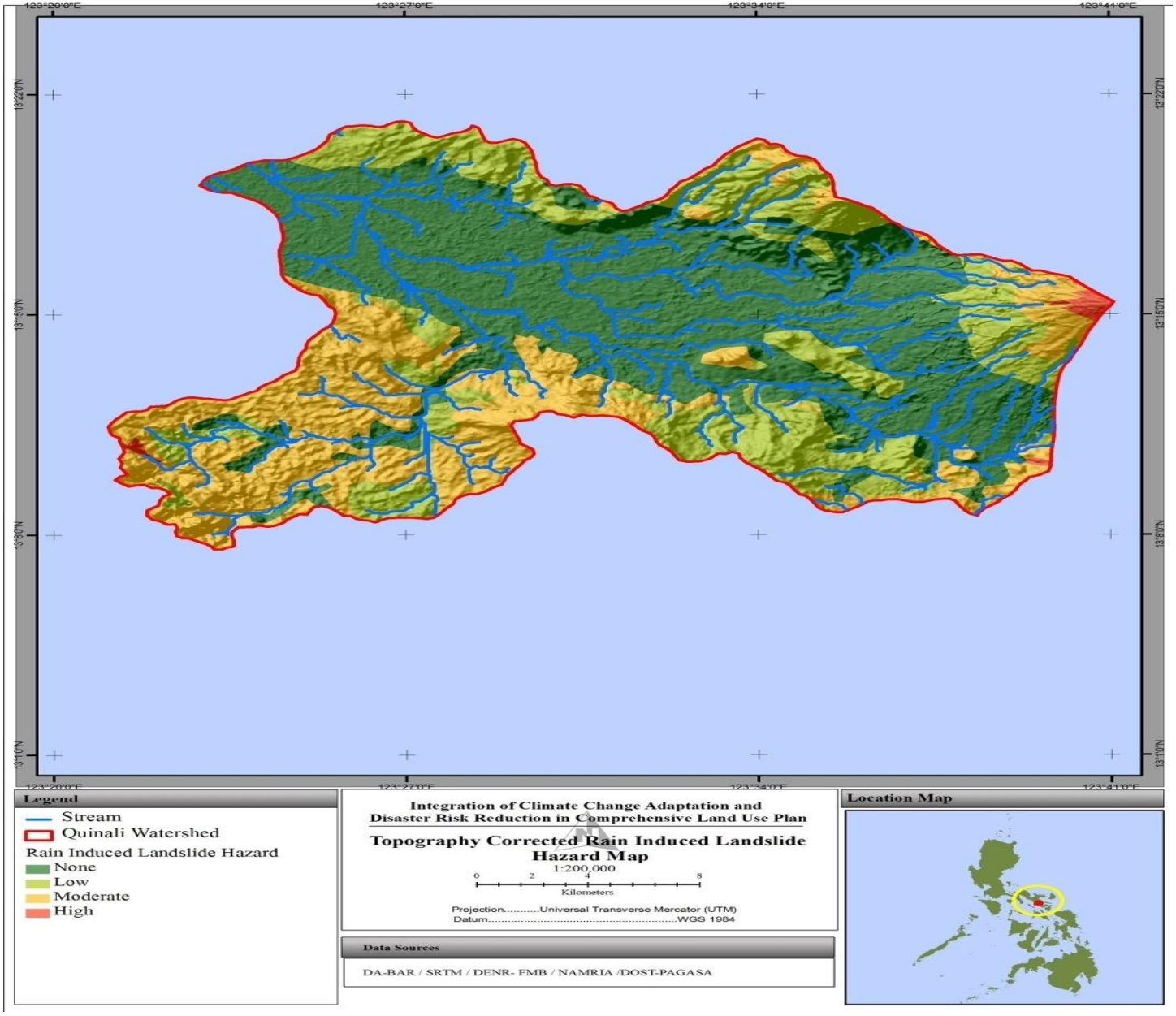
Land Cover 2003	Flood Hazard		
	Moderate		Moderately High
	2020	2050	OBS
Mangrove Forest	22	22	22
Open Forest, Coniferous	1129	1129	1129
Other Lands, Cultivated, Annual	10649	10649	10649
Other Lands, Cultivated, Perennial	9180	9180	9180
Other Lands, Grasslands	392	392	392
Other Lands, Natural, Barren	171	171	171
Other Wooded Lands, Shrubs	271	271	271
Other Wooded Lands, Grasslands	61	61	61
TOTAL	*21876*	*21876*	*21876*

Flood Hazard Map

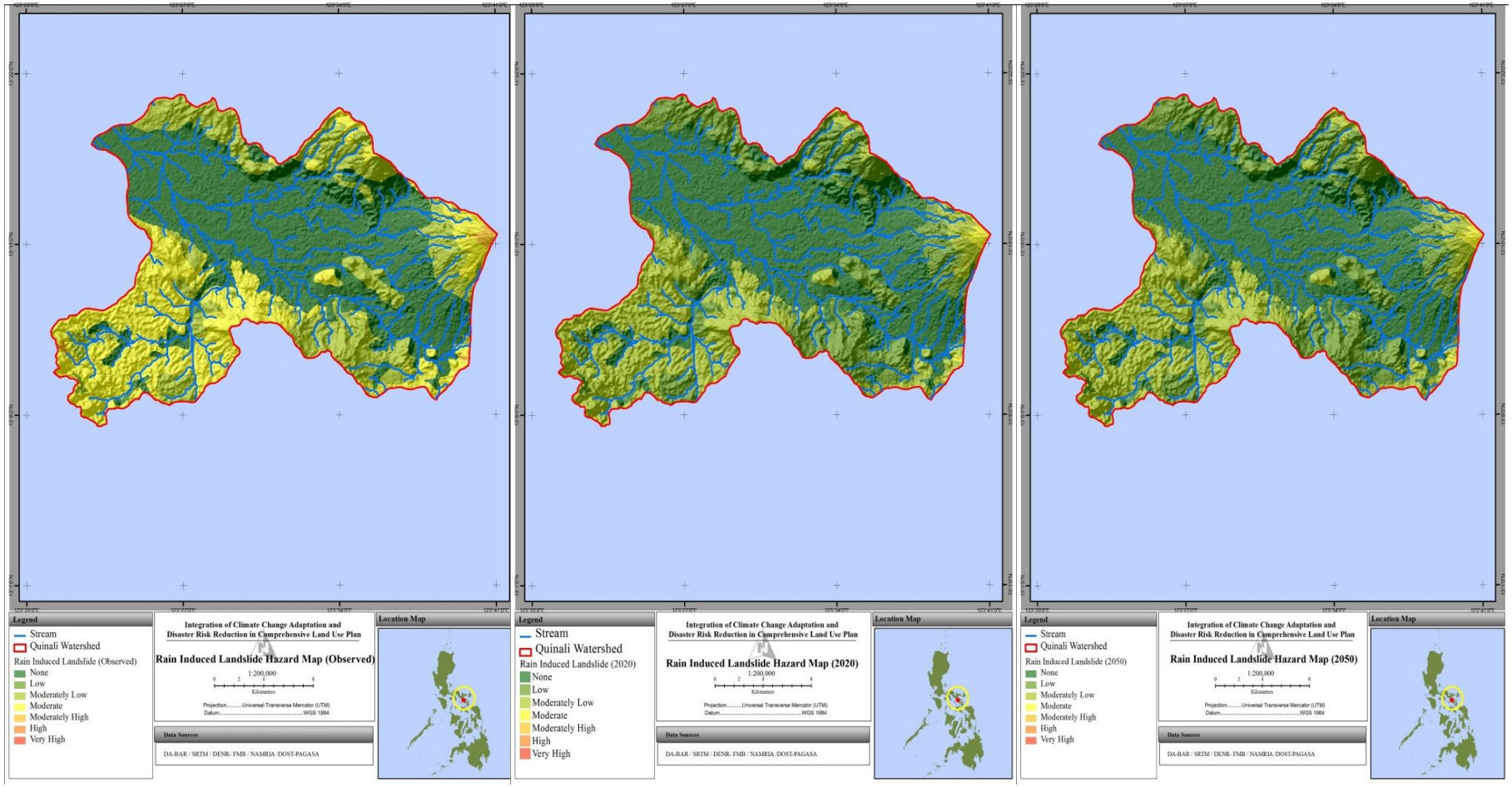
Flood Hazard	Land Capability Zoning								
	Unlimited Production			Agroforest Production			Limited Production		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
No Flood	22982	20736	20137	3102	4903	5501	687	1492	1132
Moderate		16929	16828		671	772		111	71
Mod High	17248			382			41		
TOTAL	***40229***	***37665***	***36965***	***3484***	***5573***	***6273***	***728***	***1603***	***1203***

Flood Hazard									
	Production Buffer			Protection Buffer			Strict Protection		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
No Flood	124	124	124	1222	1222	1222	3093	2733	3093
Moderate		77	77		3042	3042		1046	1086
Mod High	77			3042			1086		
TOTAL	***201***	***201***	***201***	***4264***	***4264***	***4264***	***4179***	***3778***	***4179***

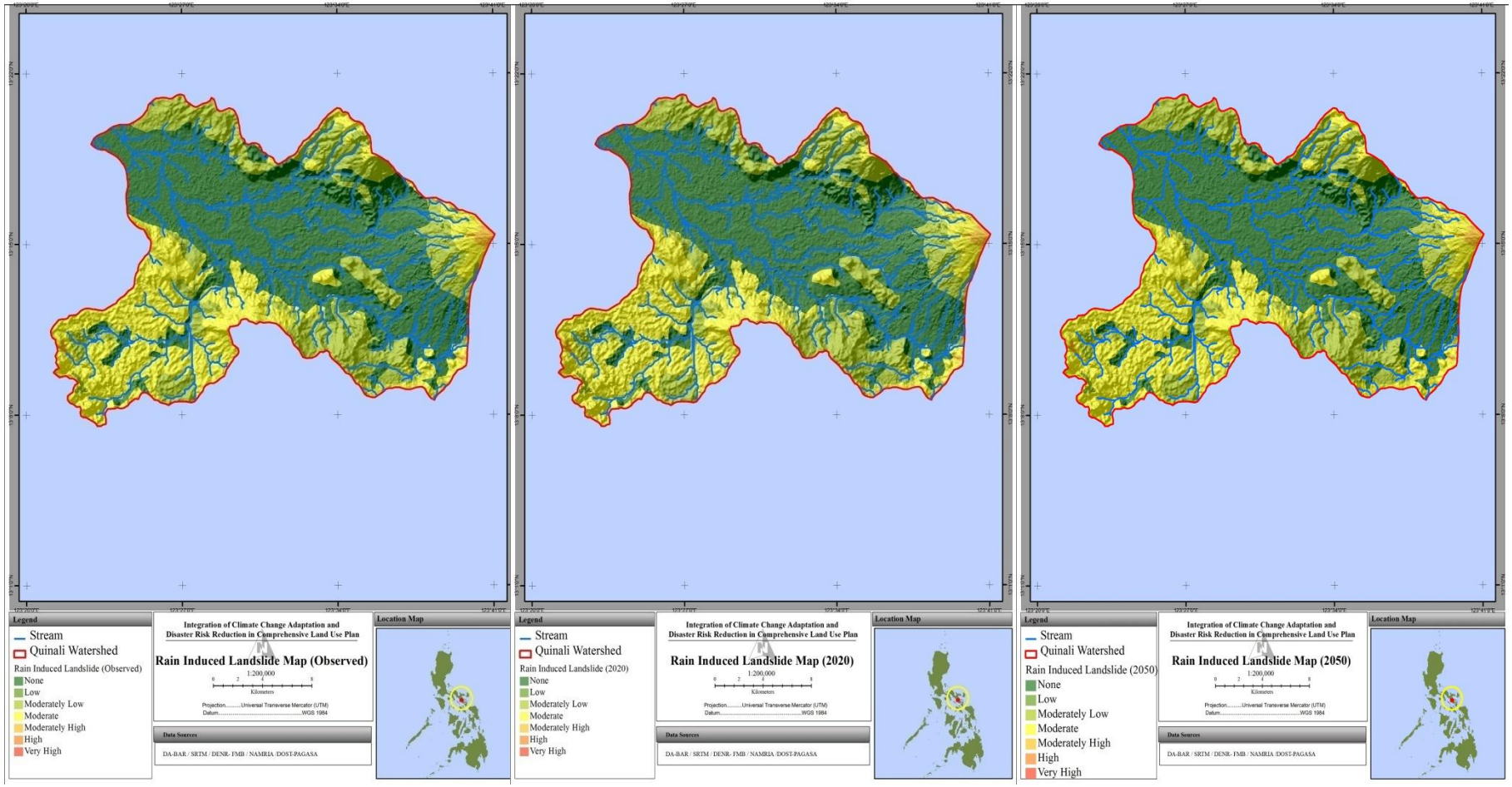
Topography Corrected Rain Induced Landslide



Projected Rain Induced Landslide Hazards (PRECIS)



Projected Rain Induced Landslide Hazards (SimCLIM)



Projected Rain Induced Landslide Hazards

Municipality	Low		Moderately Low			Moderate			Moderately High
	2020	2050	OBS	2020	2050	OBS	2020	2050	OBS
Bato									
Bato Lake									
Camalig	918	918	918	1119	1119	1119	55	55	55
Guinobatan	4257	4257	4257	622	622	622	122	122	122
Libon	125	125	125	1829	1829	1829	39	39	39
Ligao City	2264	2264	2264	4022	4022	4022	53	53	53
Oas	1784	1784	1784	6292	6292	6292	32	32	32
Polangui	3080	3080	3080	223	223	223			
Tabaco City				0	0	0	11	11	11
TOTAL	*12428*	*12428*	*12428*	*14107*	*14107*	*14107*	*313*	*313*	*313*

Projected Rain Induced Landslide Hazards

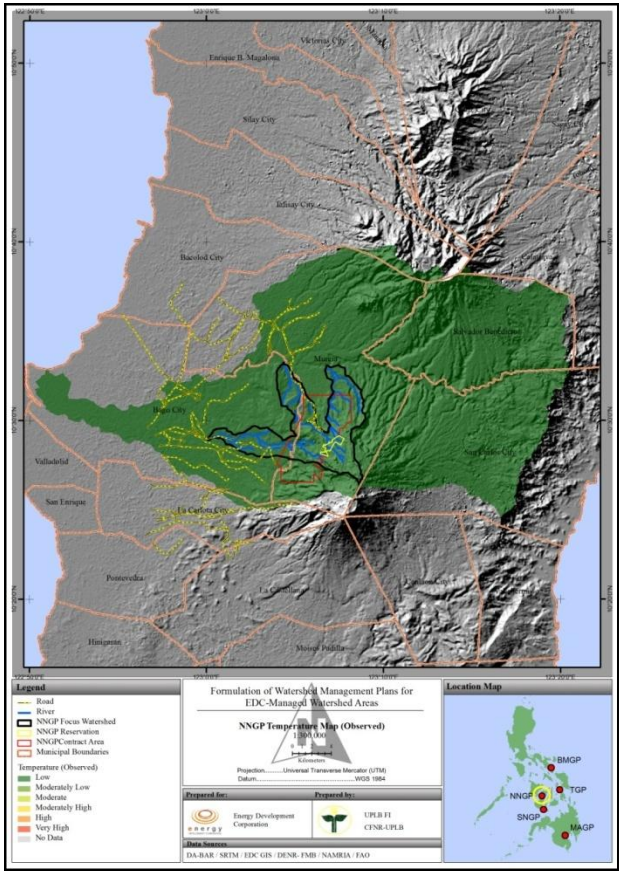
Land Cover 2003			Moderately Low			Moderate			Mod High
	2020	2050	OBS	2020	2050	OBS	2020	2050	OBS
Open Forest	146	146	146	115	115	115	0	0	0
Cultivated, Annual	3975	3975	3975	8804	8804	8804	70	70	70
Cultivated, Perennial	6590	6590	6590	4154	4154	4154	34	34	34
Grasslands	618	618	618	25	25	25			
Natural, Barren	129	129	129	304	304	304	167	167	167
Shrubs	740	740	740	679	679	679	42	42	42
Grasslands	229	229	229	26	26	26			
TOTAL	*12428*	*12428*	*12428*	*14107*	*14107*	*14107*	*313*	*313*	*313*

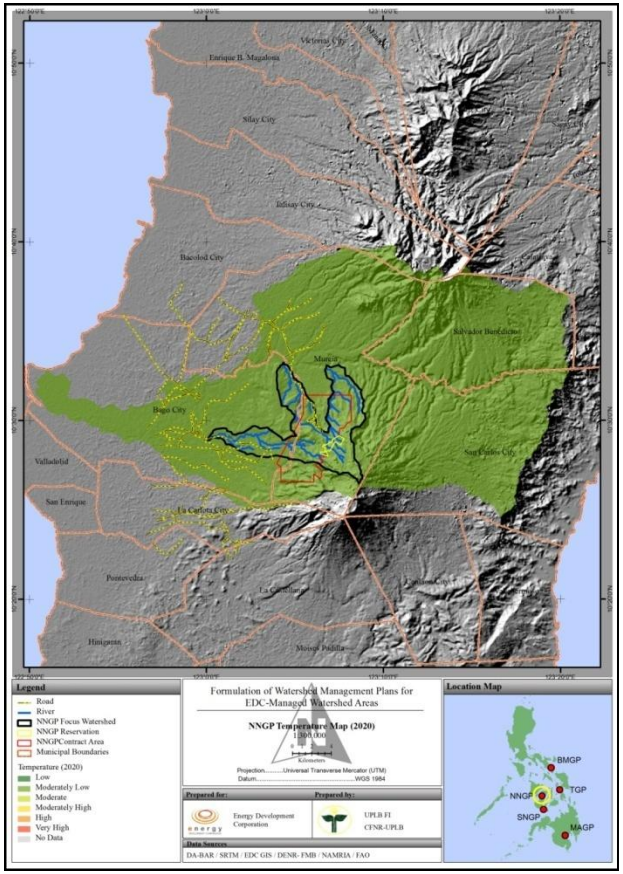
Projected Rain Induced Landslide Hazards

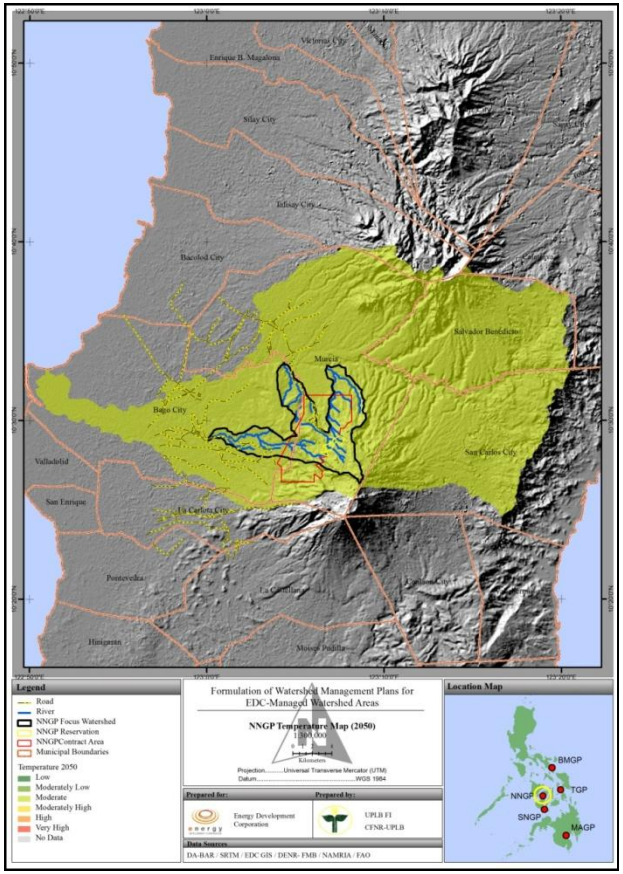
Rain Induced Landslide	Land Capability Zoning								
	Unlimited Production			Agroforest Production			Limited Production		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Low		7966	7667		2247	2546		513	414
Mod Low	8610	8517	8449	1834	2707	2775	183	902	606
Moderate	10287	25	25	1052	20	20	491	28	28
Mod high	33			11			28		
TOTAL	***18931***	***16508***	***16141***	***2897***	***4974***	***5340***	***702***	***1443***	***1048***

Rain Induced Landslide	Land Capability Zoning								
	Production Buffer			Protection Buffer			Strict Protection		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Low		35	35		834	834		833	931
Moderately Low	35	31	31	834	971	971	931	979	1275
Moderate	31	0	0	971	29	29	1275	211	211
Moderately high	0			29			211		
TOTAL	***66***	***66***	***66***	***1834***	***1834***	***1834***	***2417***	***2023***	***2417***

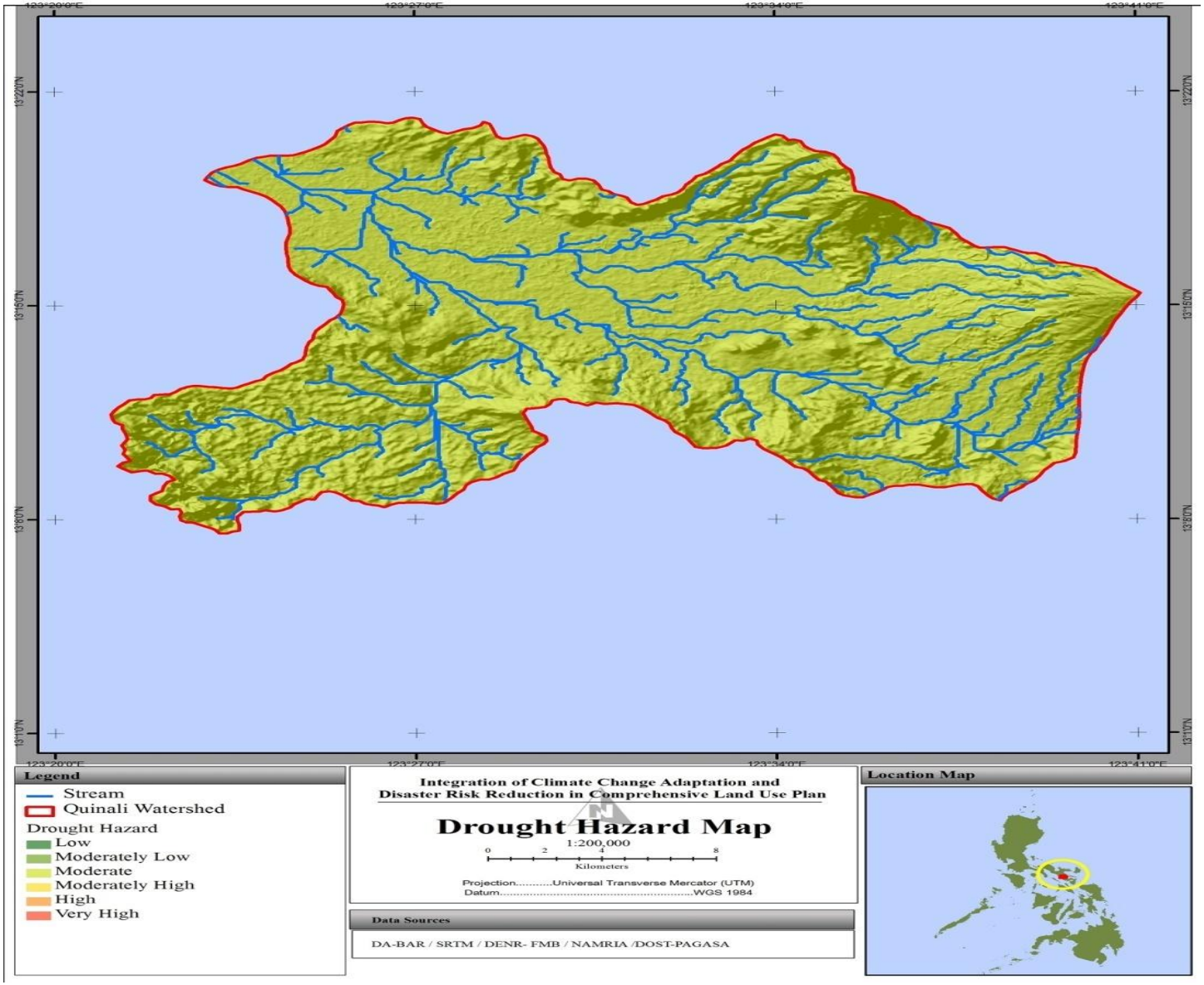
Mean Frequency of Daily Max Temp Maps (Observed, 2020,2050)



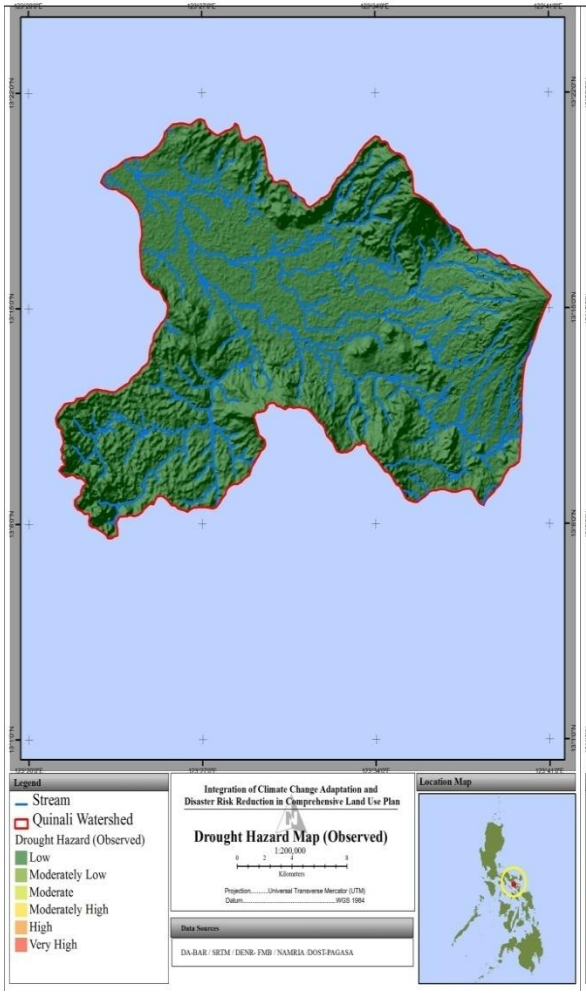


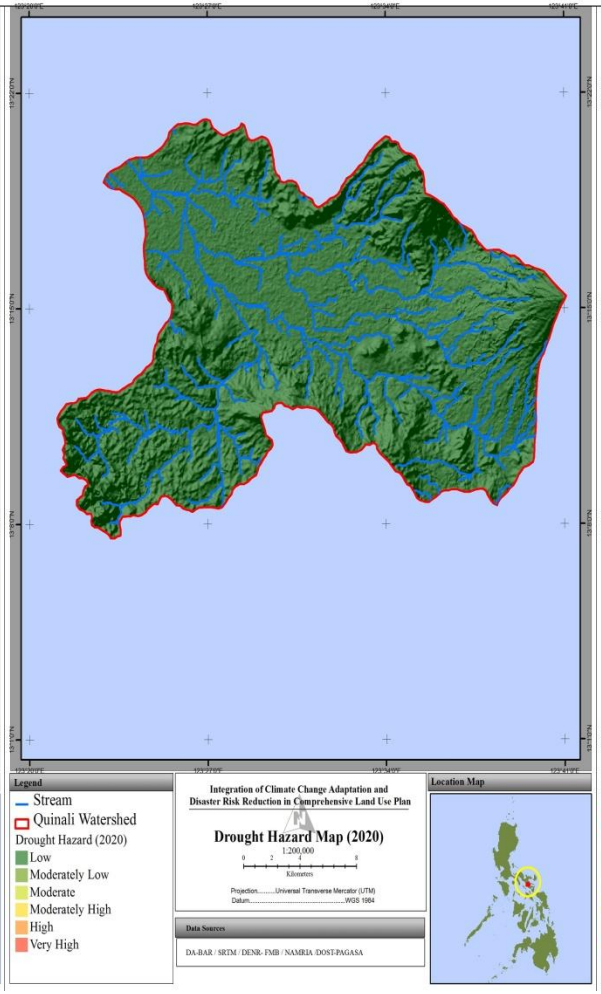


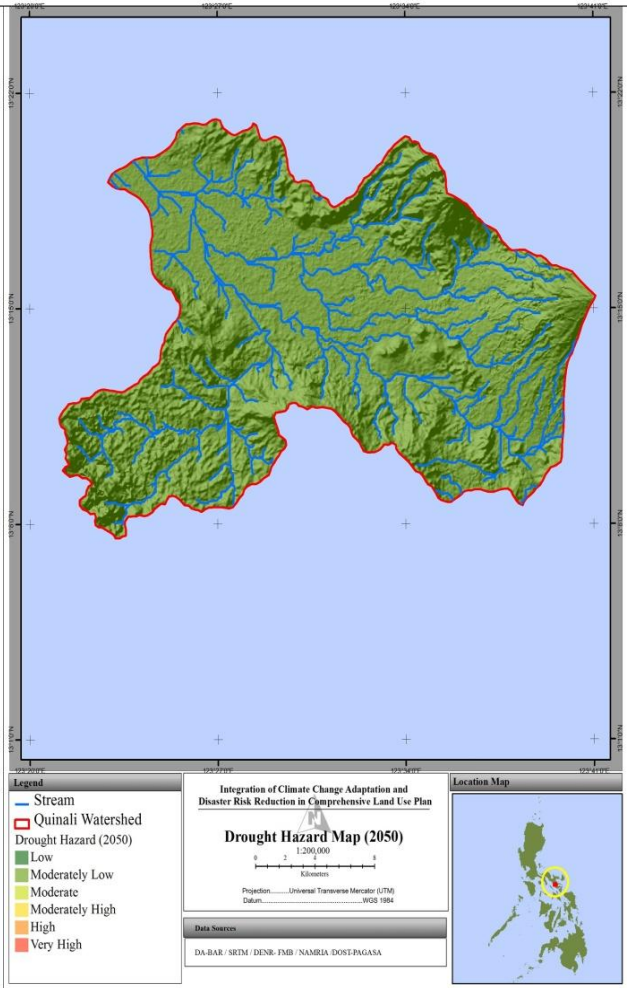
Validated Drought Hazard Maps



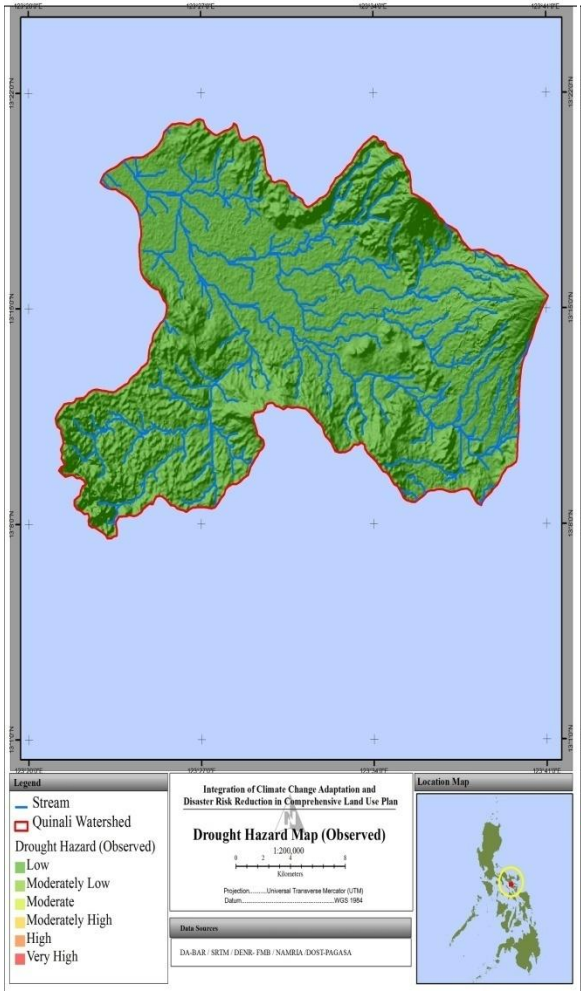
Drought Hazard Maps (Observed, 2020, 2050) (PRECIS)

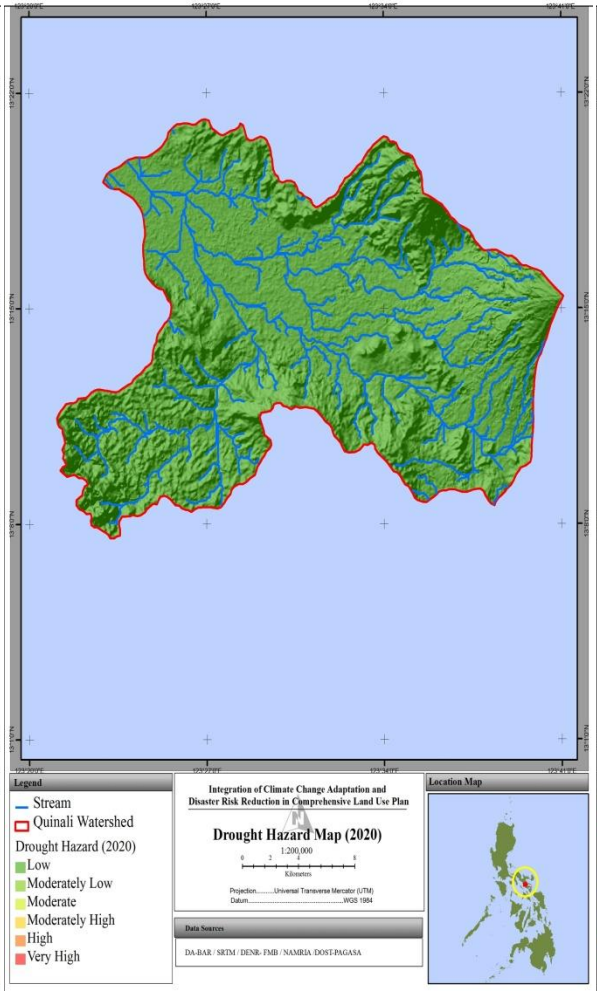


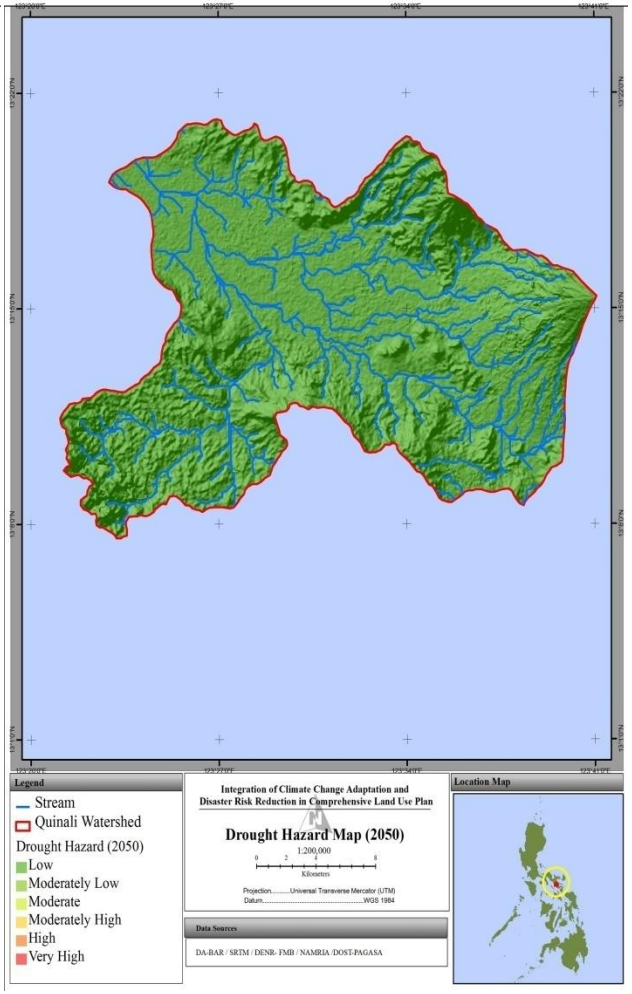




Drought Hazard Maps (Observed, 2020, 2050) (SimCLIM)







Drought Hazard Maps (Observed, 2020, 2050)

Municipality	Drought Hazard		
	Low		Mod Low
	OBS	2020	2050
Bato	4	4	4
Bato Lake	10	10	10
Camalig	4211	4211	4211
Guinobatan	9414	9414	9414
Libon	5886	5886	5886
Ligao City	13826	13826	13826
Oas	12966	12966	12966
Polangui	7237	7237	7237
Tabaco City	11	11	11
TOTAL	*53566*	*53566*	*53566*

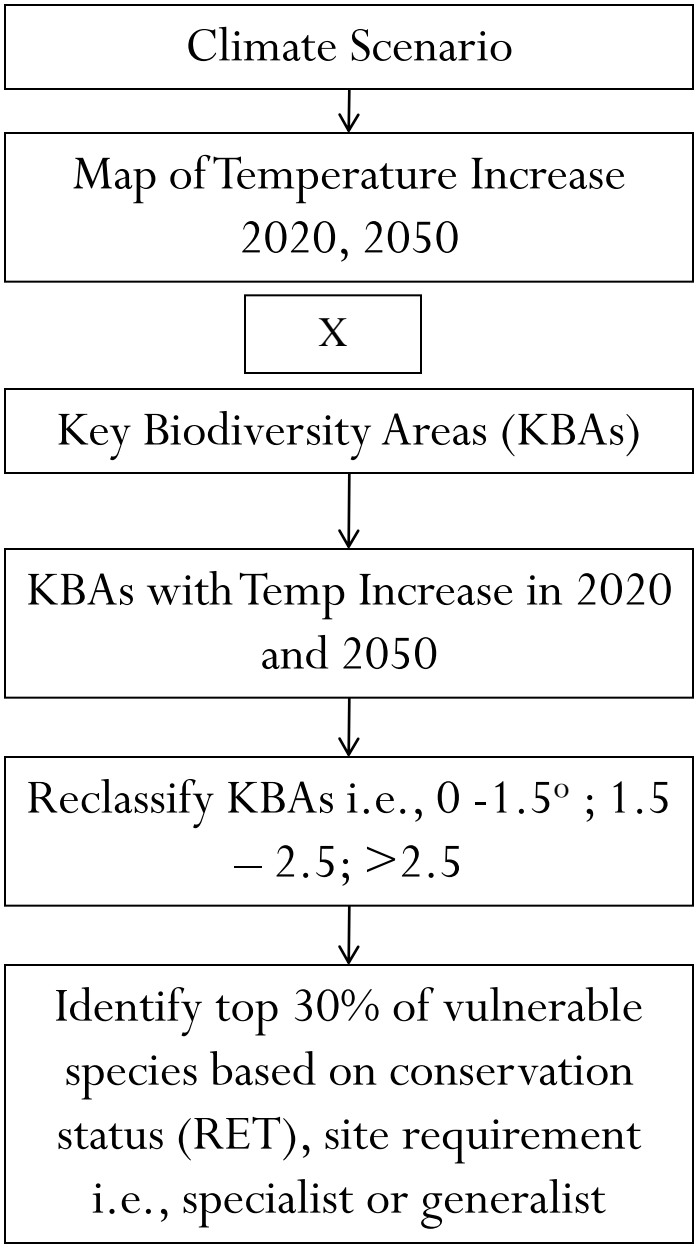
Drought Hazard Maps (Observed, 2020, 2050)

Land Cover 2003	Drought Hazard		
	Low		Mod Low
	OBS	2020	2050
Mangrove Forest	39	39	39
Open Forest, Coniferous	1987	1987	1987
Other Lands, Cultivated, Annual	23880	23880	23880
Other Lands, Cultivated, Perennial	23834	23834	23834
Other Lands, Grasslands	1354	1354	1354
Other Lands, Natural, Barren	691	691	691
Other Wooded Lands, Shrubs	1526	1526	1526
Other Wooded Lands, Grasslands	255	255	255
TOTAL	*53566*	*53566*	*53566*

Drought Hazard Maps (Observed, 2020, 2050)

Rain Induced Landslide	Land Capability Zoning								
	Unlimited Production			Agroforest Production			Limited Production		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Low		7966	7667		2247	2546		513	414
Mod Low	8610	8517	8449	1834	2707	2775	183	902	606
Moderate	10287	25	25	1052	20	20	491	28	28
Mod High	33			11			28		
TOTAL	***18931***	***16508***	***16141***	***2897***	***4974***	***5340***	***702***	***1443***	***1048***

Rain Induced Landslide									
	Production Buffer			Protection Buffer			Strict Protection		
	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Low		35	35		834	834		833	931
Mod Low	35	31	31	834	971	971	931	979	1275
Moderate	31	0	0	971	29	29	1275	211	211
Mod High	0			29			211		
TOTAL	***66***	***66***	***66***	***1834***	***1834***	***1834***	***2417***	***2023***	***2417***


Climate Scenario
Map of Temperature Increase 2020, 2050
X
Key Biodiversity Areas (KBAs)
KBAs with Temp Increase in 2020 and 2050
Reclassify KBAs i.e., 0 -1.5° ; 1.5 – 2.5; >2.5
Identify top 30% of vulnerable species based on conservation status (RET), site requirement i.e., specialist or generalist

Category	Change in Temperature (^{O}C)	Risk of Extinction due to Temperature Change
1	-2 to 0	No risk
2	0.1 to 1.5	10% of plants and animals at risk
3	1.5 to 2.0	20% of plants and animals at risk
4	2 to 2.5	30% of plants and animals at risk
5	>2.5	40% of plants and animals at risk

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
1	Succulents, herbs, moss, epiphytes (orchids)	Endemic	Climax species	RET
2	Succulents, herbs, moss, epiphytes (orchids)	Widespread	Climax species	RET
3	Succulents, herbs, moss, epiphytes (orchids)	Endemic or Widespread	Climax species	Non-RET
4	Succulents, herbs, moss, epiphytes (orchids)	Endemic	Pioneer species	RET
5	Succulents, herbs, moss, epiphytes (orchids)	Widespread	Pioneer species	RET

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
6	Succulents, herbs, moss, epiphytes (orchids)	Endemic or Widespread	Pioneer species	Non-RET
7	Small trees	Endemic	Climax species	RET
8	Small trees	Widespread	Climax species	RET
9	Small trees	Endemic or Widespread	Climax species	Non-RET
10	Medium trees	Endemic	Climax species	RET

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
11	Medium trees	Widespread	Climax species	RET
12	Medium trees	Endemic or Widespread	Climax species	Non-RET
13	Large trees	Endemic	Climax species	RET
14	Large trees	Widespread	Climax species	RET
15	Large trees	Endemic or Widespread	Climax species	Non-RET

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
16	Small trees	Endemic	Pioneer species	RET
17	Small trees	Widespread	Pioneer species	RET
18	Small trees	Endemic or Widespread	Pioneer species	Non-RET
19	Medium trees	Endemic	Pioneer species	RET
20	Medium trees	Widespread	Pioneer species	RET

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
21	Medium trees	Endemic or Widespread	Pioneer species	Non-RET
22	Large trees	Endemic	Pioneer species	RET
23	Large trees	Widespread	Pioneer species	RET
24	Large trees	Endemic or Widespread	Pioneer species	Non-RET
25	Other plants	Endemic	Climax species	RET

Rank	Type	Endemic or Widespread	Ecological Status	Conservation Status
26	Other plants	Widespread	Climax species	RET
27	Other plants	Endemic or Widespread	Climax species	Non-RET
28	Other plants	Endemic	Pioneer species	RET
29	Other plants	Widespread	Pioneer species	RET
30	Other plants	Endemic or Widespread	Pioneer species	Non-RET

Rank	Class	Endemic or Widespread	Conservation Status
1	Amphibian	Endemic	Endangered
2	Amphibian	Endemic	Threatened
3	Amphibian	Endemic	Rare
4	Reptile	Endemic	Endangered
5	Reptile	Endemic	Threatened
6	Reptile	Endemic	Rare
7	Mammal	Endemic	Endangered
8	Mammal	Endemic	Threatened
9	Mammal	Endemic	Rare
10	Bird	Endemic	Endangered
11	Bird	Endemic	Threatened
12	Bird	Endemic	Rare

Rank	Class	Endemic or Widespread	Conservation Status
13	Amphibian	Widespread	Endangered
14	Amphibian	Widespread	Threatened
15	Amphibian	Widespread	Rare
16	Reptile	Widespread	Endangered
17	Reptile	Widespread	Threatened
18	Reptile	Widespread	Rare
19	Mammal	Widespread	Endangered
20	Mammal	Widespread	Threatened
21	Mammal	Widespread	Rare
22	Bird	Widespread	Endangered
23	Bird	Widespread	Threatened
24	Bird	Widespread	Rare

Frequency of Rainfall Events with at least 100mm	Category
1-2	1 (Very Low)
2-3	2 (Low)
3-4	3 (Moderate)
4-5	4 (High)
>5	5 (Very High)

Future Freq of Rainy Days with at least 100mm of Rain	Existing Rain-Induced Landslide Hazard		
	Low	Moderate	High
1 (Very Low)	Low	Moderate	High
2 (Low)	Low	Moderate	High
3 (Moderate)	Moderate	Moderate	High
4 (High)	High	High	Very High
5 (Very High)	Very High	Very High	Very High

Affected Areas	Areas (ha) Exposed to Rain-Induced Landslide Risk				
	Very Low (0.2)	Low (0.4)	Moderate (0.6)	High (0.8)	Very high (1.0)
Farm					
Plantation					
Settlement					
Road					
Others					
Total					

THANK YOU

Contact us:

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