HYDRO ENERGY RESOURCE ASSESSMENT OF ILOCOS NORTE RIVER BASIN, PHILIPPINES

Presentor: Engr. Jholeeh Charls T. Madalipay

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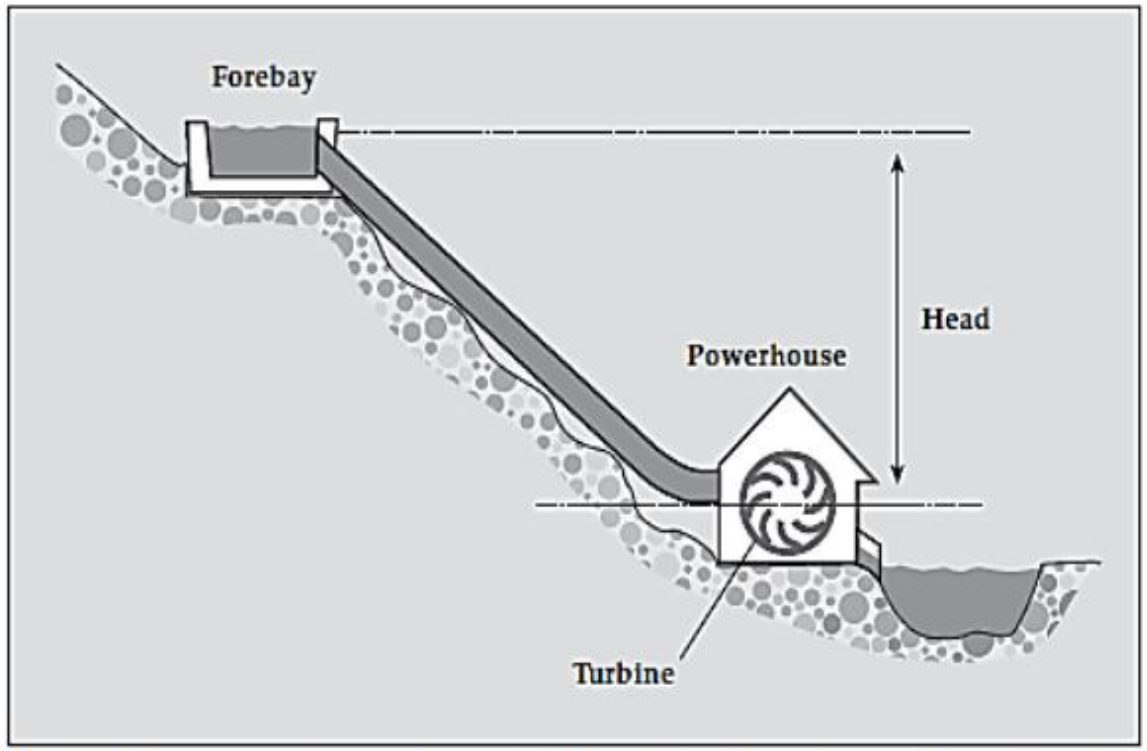
PHIL-LIDAR 2: NATIONWIDE DETAILED RESOURCE ASSESSMENT USING LIDAR SURVEYS AND OTHER REMOTELY SENSED DATA

MARIANO MARCOS STATE UNIVERSITY, CITY OF BATAC, PHILIPPINES

INTRODUCTION

Hydropower is a renewable energy that is widely-used worldwide and a reliable source of electrical power. In the Philippines, hydrologic resources are abundant and proven to be a viable clean energy source. Philippines has a goal to improve fuel mix used for industrial and domestic electrical consumption for renewable energy.

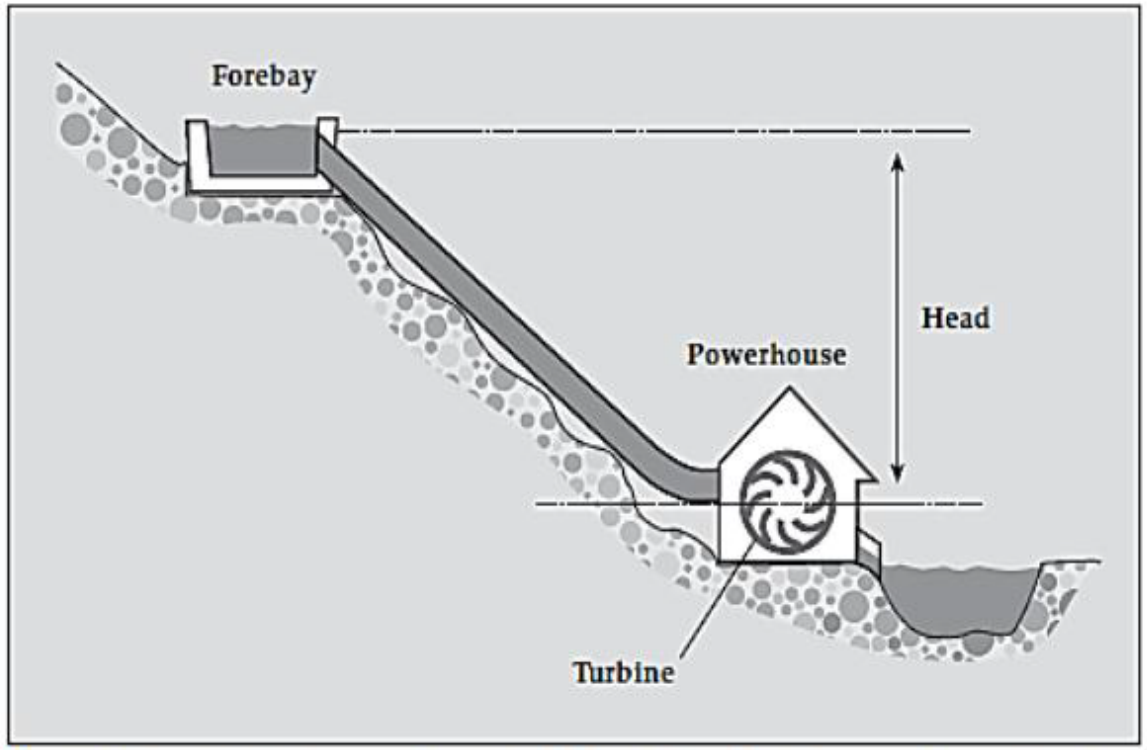
INTRODUCTION



The potential annual power generation of a hydro power project is proportional to the head and flow of water. The requirements for a hydro-electric power plant are **flow, head** and **runoff**.

Flow is defined as the quantity of water moving through a specified point per unit of time.

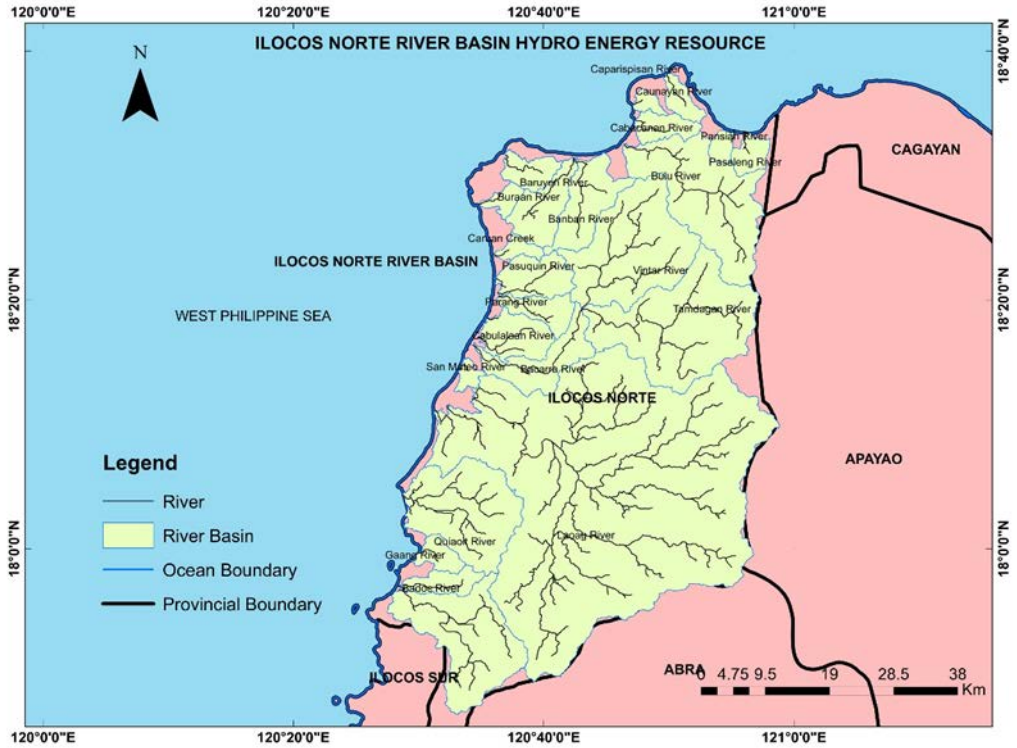
INTRODUCTION



Runoff is the rainfall that actually does enter the stream as either surface or subsurface flow.

Head is the difference in elevation between two water levels, it is the vertical distance of the water falls. Higher heads require less water to produce a given amount of power.

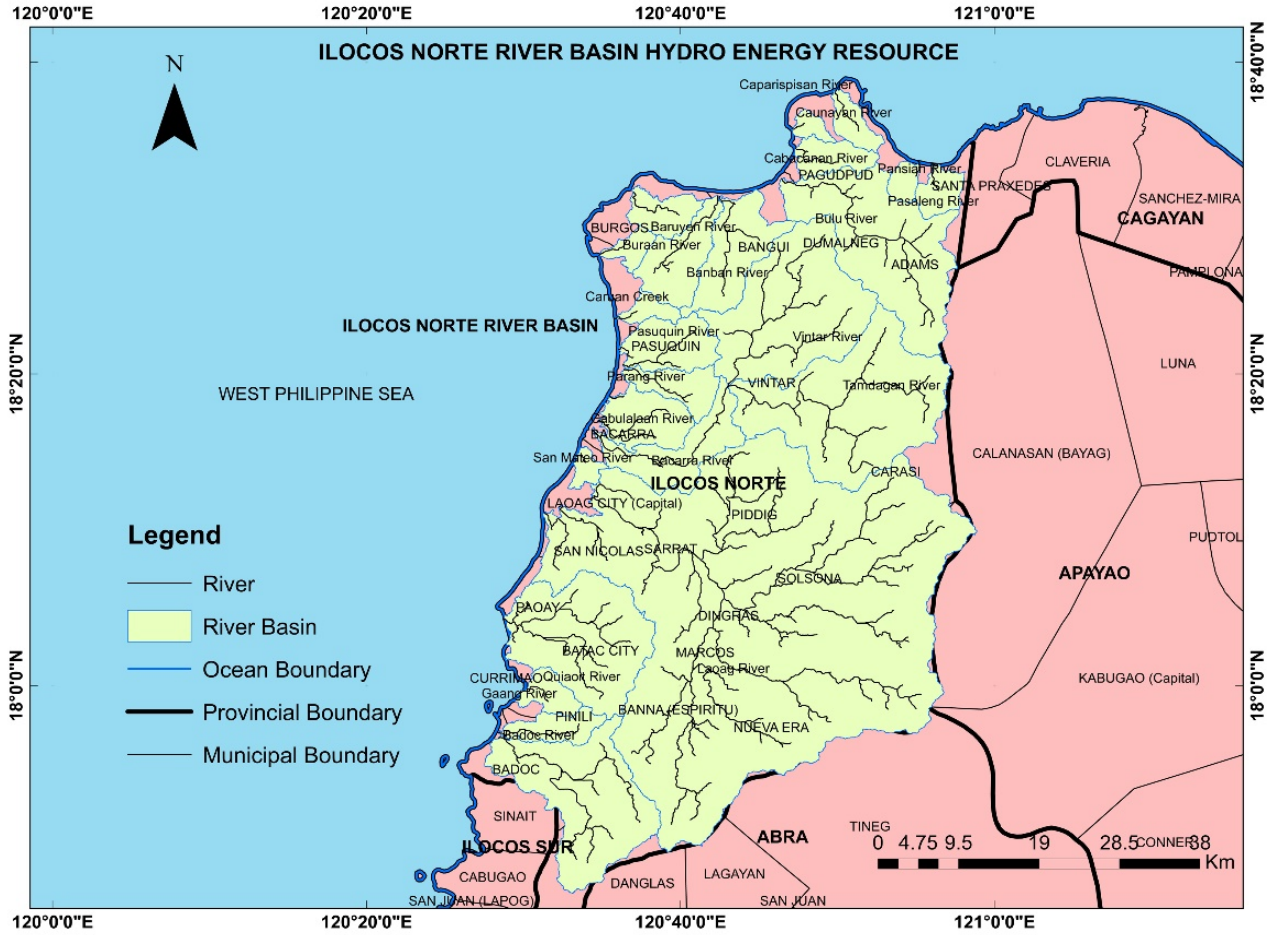
OBJECTIVES



The study was aimed to use remote sensing data particularly Synthetic Aperture Radar (SAR) and Geographic Information System (GIS) technologies to assess the hydro-energy resource potential of Ilocos Norte river basin. Moreover, the study was aimed to delineate river reaches, simulated flow, detect suitable head locations and identify potential locations for possible establishment of hydro-energy power plants.

STUDY AREA


Ilocos Norte


ILOCOS NORTE RIVER BASIN HYDRO ENERGY RESOURCE
120°0'0"E
120°20'0"E
120°40'0"E
121°0'0"E
18°40'0"N
18°20'0"N
18°0'0"N
N
ILOCOS NORTE RIVER BASIN
WEST PHILIPPINE SEA
ILOCOS NORTE
ILOCOS SUR
ABRA
APAYAO
CAGAYAN
KABUGAO (Capital)
LAOAG CITY (Capital)
Legend
River
River Basin
Ocean Boundary
Provincial Boundary
Municipal Boundary
0 4.75 9.5 19 28.5 38
Km

METHODOLOGY

Dataset used in the study

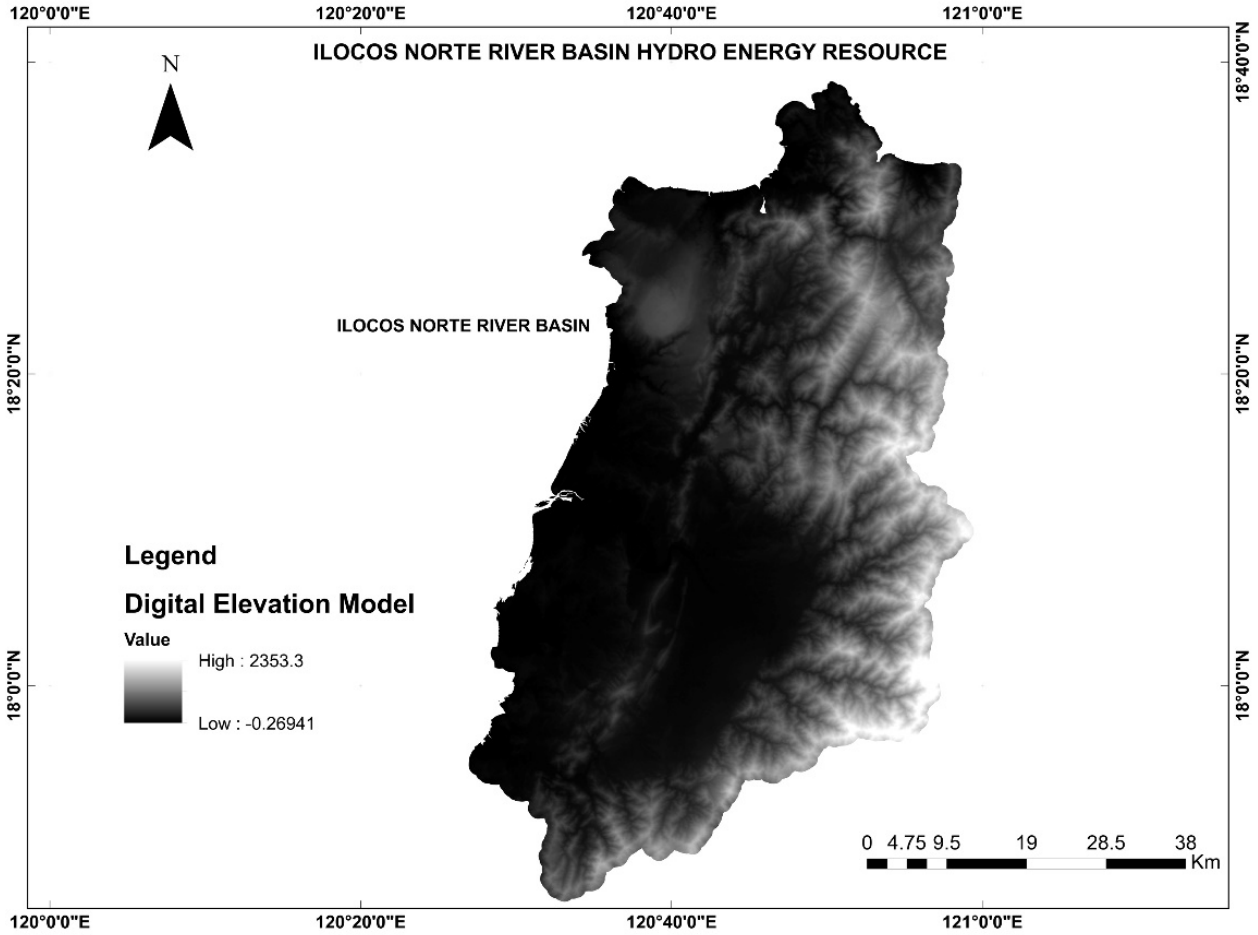
- Synthetic Aperture Radar (SAR)

  -Location: Ilocos Norte

  -Area: 308478.097412 ha

  -Resolution: 10-meters

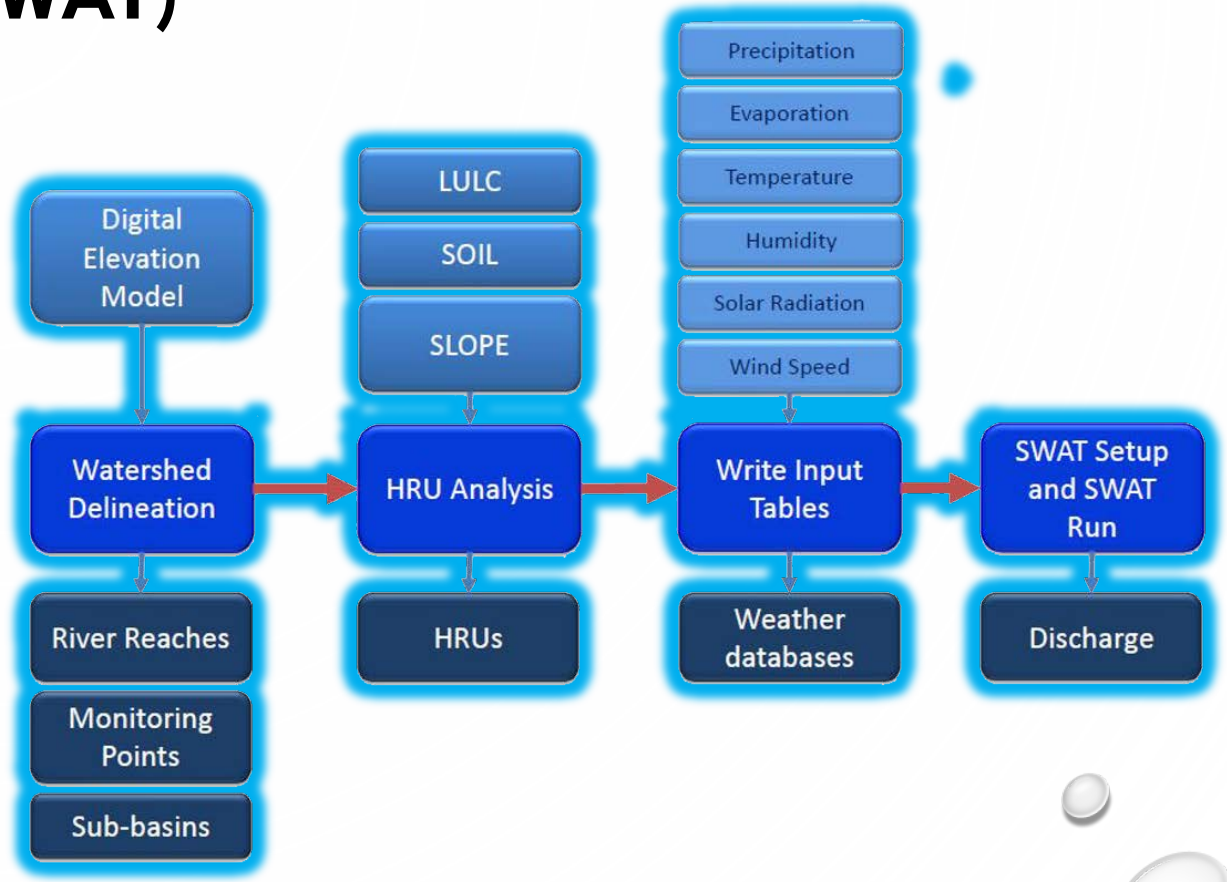
  -Acquisition Year: 2012



METHODOLOGY

Soil and Water Assessment Tool (SWAT)

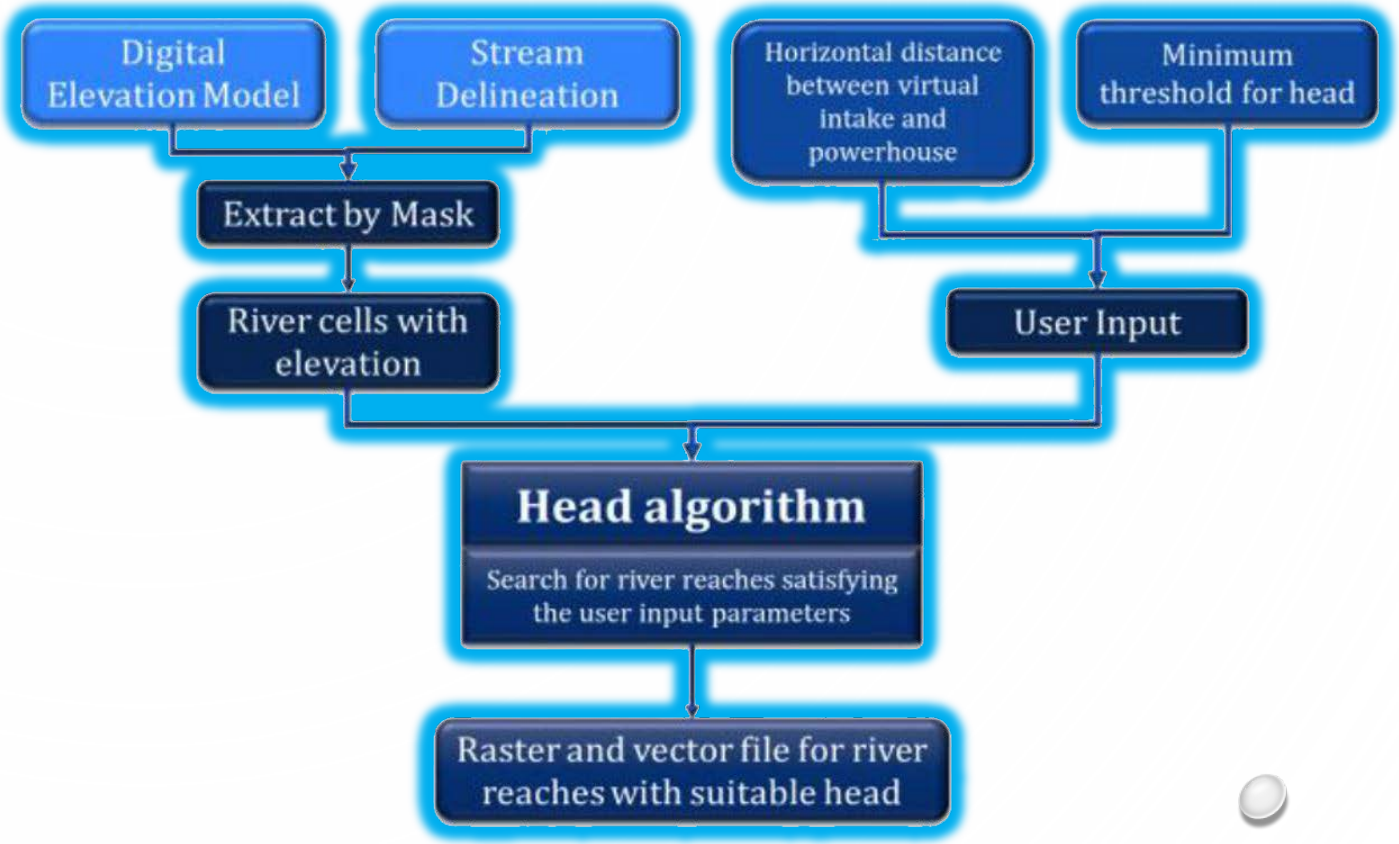
-is a river basin, or watershed, scale model developed to predict the effect of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods of time.



METHODOLOGY

Head Determination Algorithm

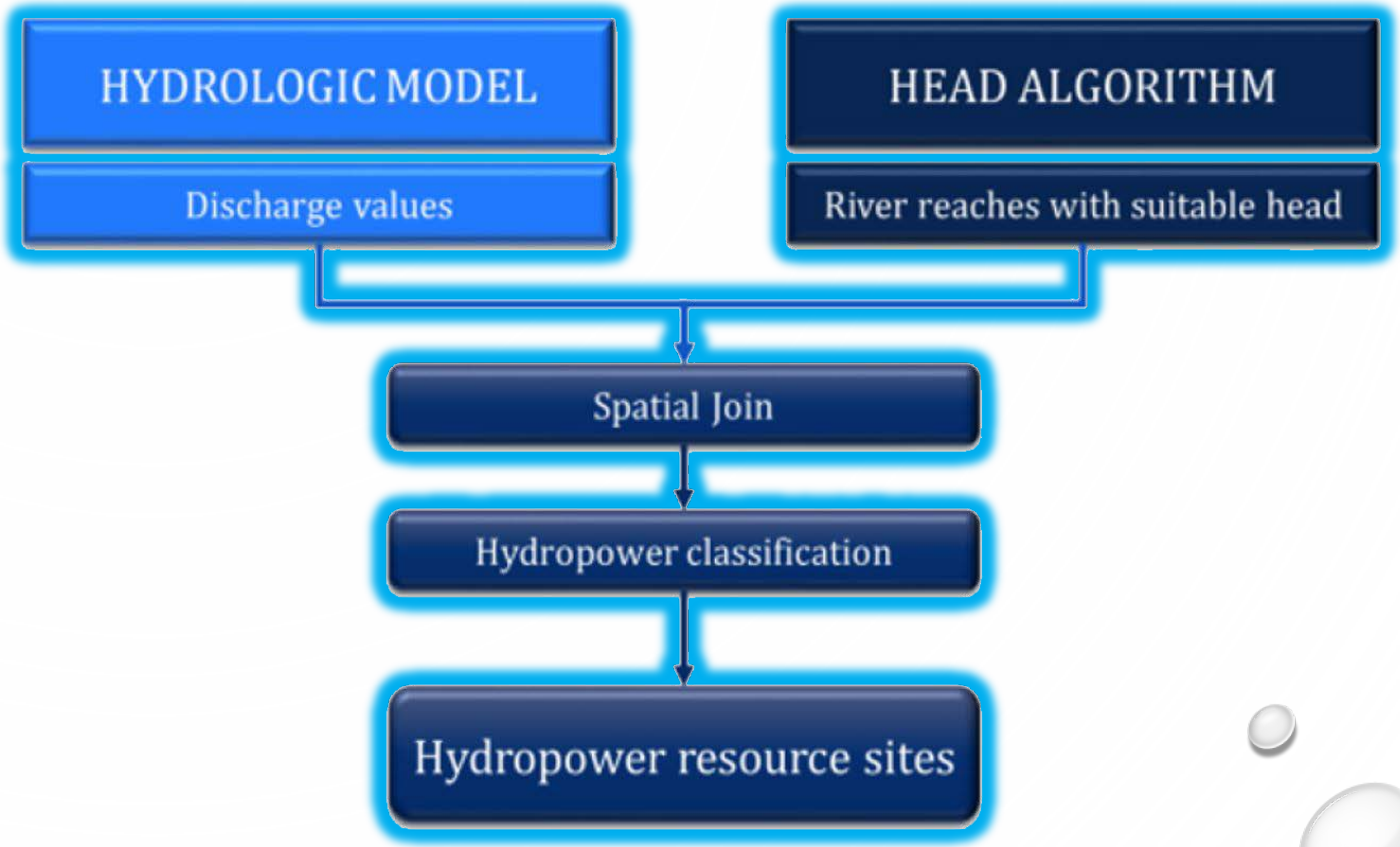
-program developed by University of the Philippines – Diliman REMap Hydro team to extract heads from delineated river cells by defining the minimum head threshold and horizontal distance between the virtual intake and powerhouse.



METHODOLOGY

Power Calculation and Classification

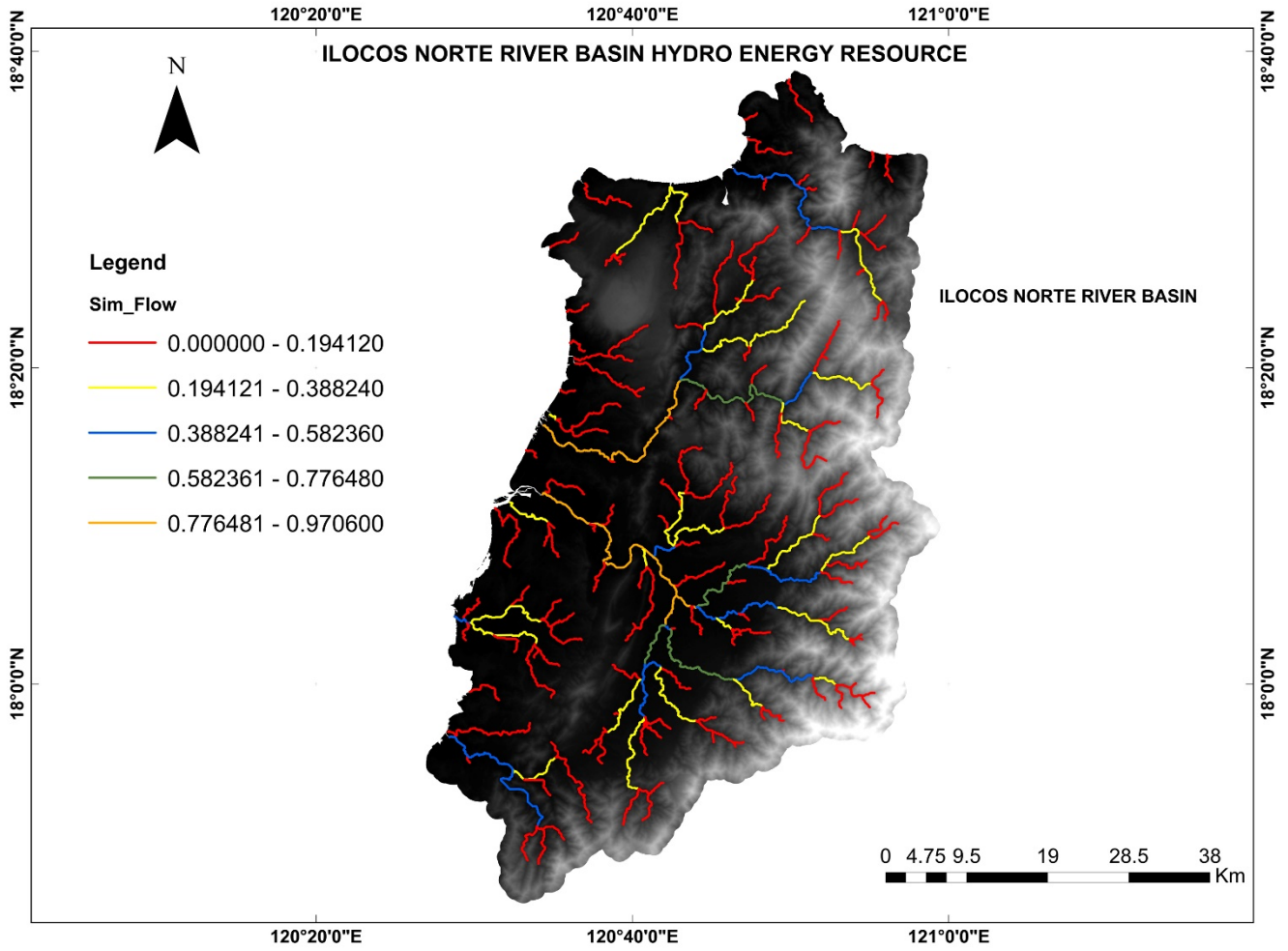
- Flow/Discharge values from SWAT Simulation
- Head features derived from Head Determination Algorithm



RESULTS

- Simulated River Flow using SWAT

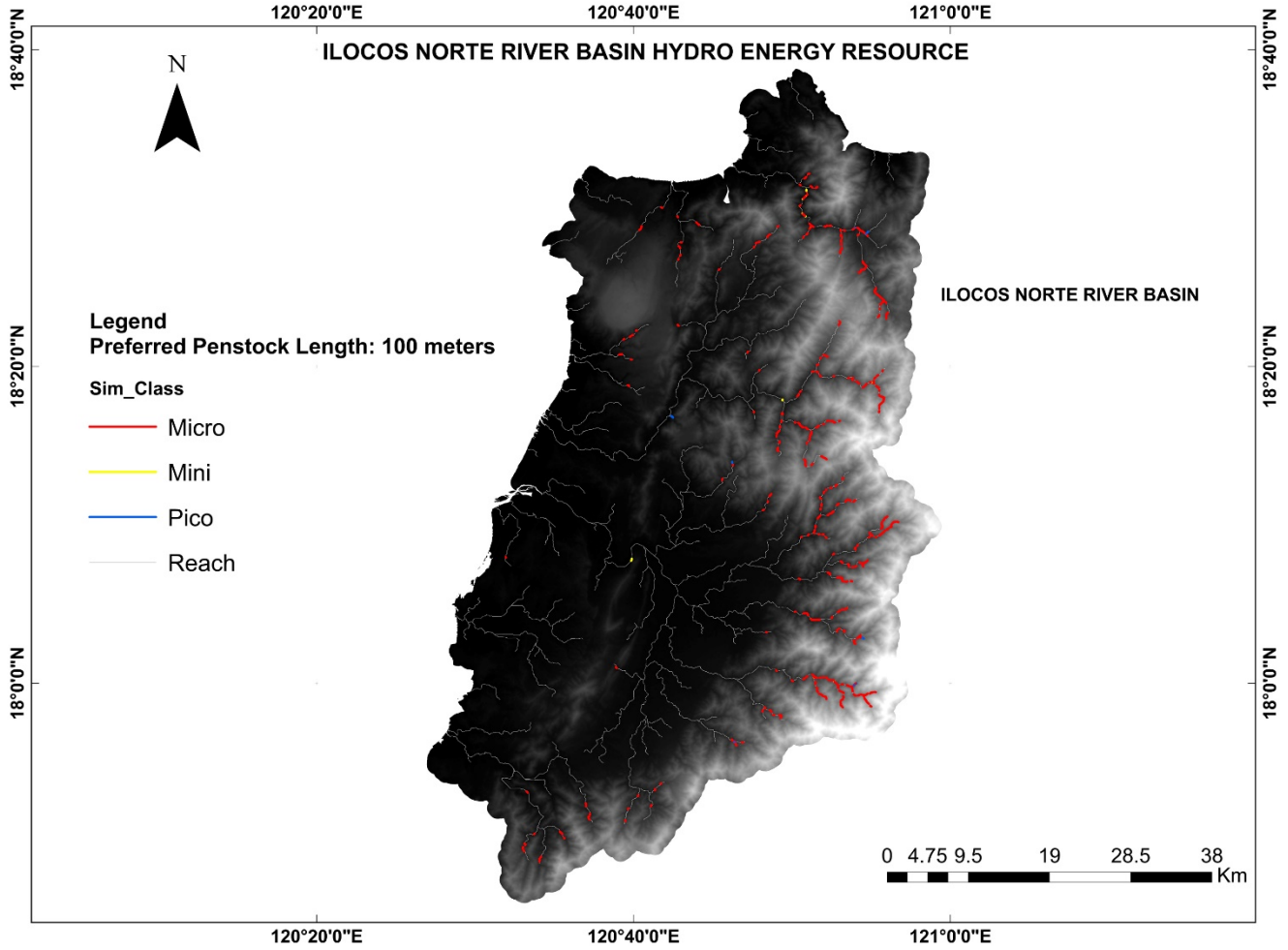
Flow		
		Reach
Minimum Flow	0.00148 m^3/s	83
Maximum Flow	0.9706 m^3/s	110



RESULTS

Power Distribution

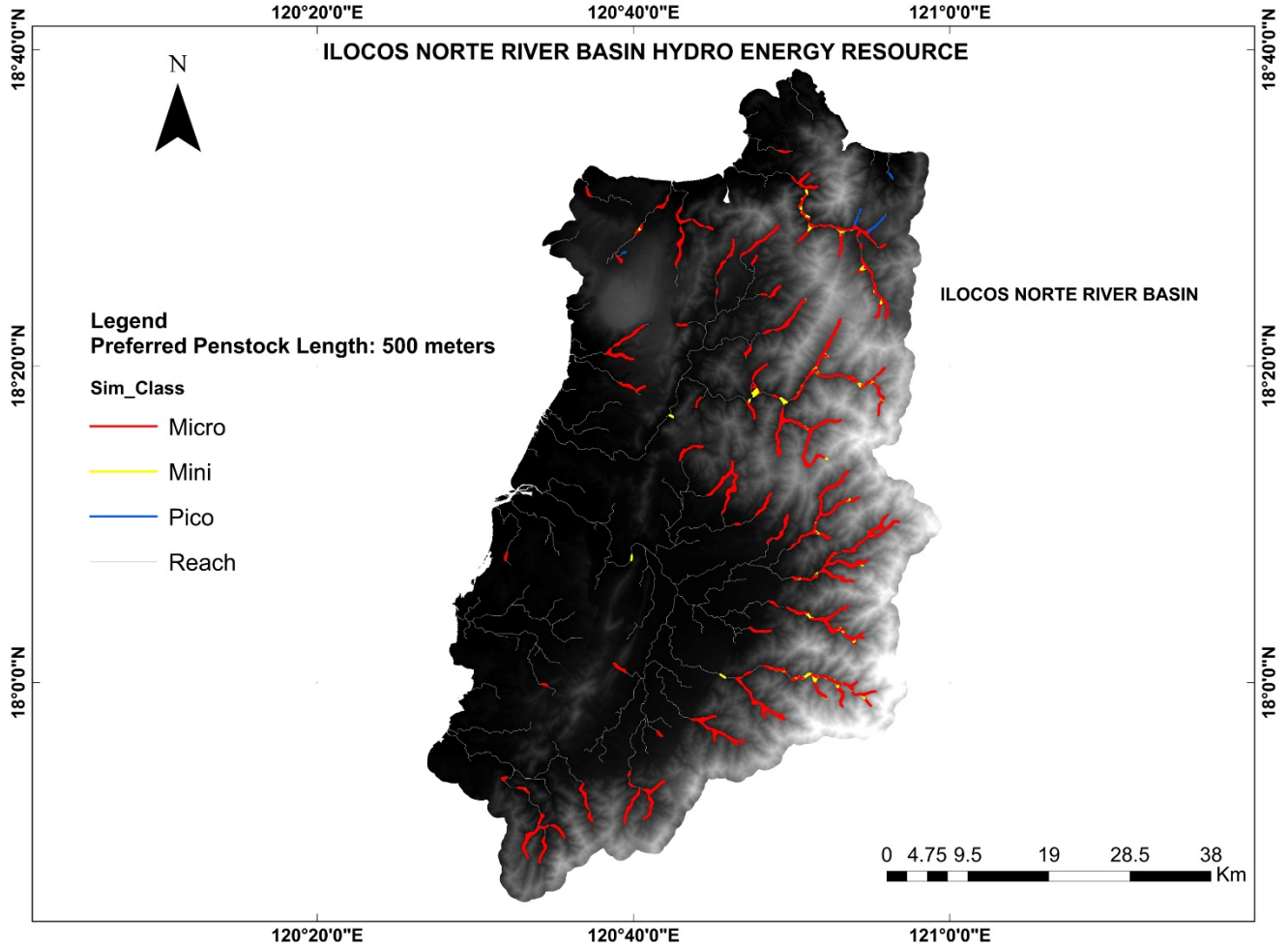
100 m Preferred Penstock length		
Power Distribution	**Count**	**Percentage**
Pico	47	1.81%
Micro	2471	95.30%
Mini	75	2.89%
Minimum Simulated Power		2.32 kw
Maximum Simulated Power		180.09 kw



RESULTS

- Power Distribution

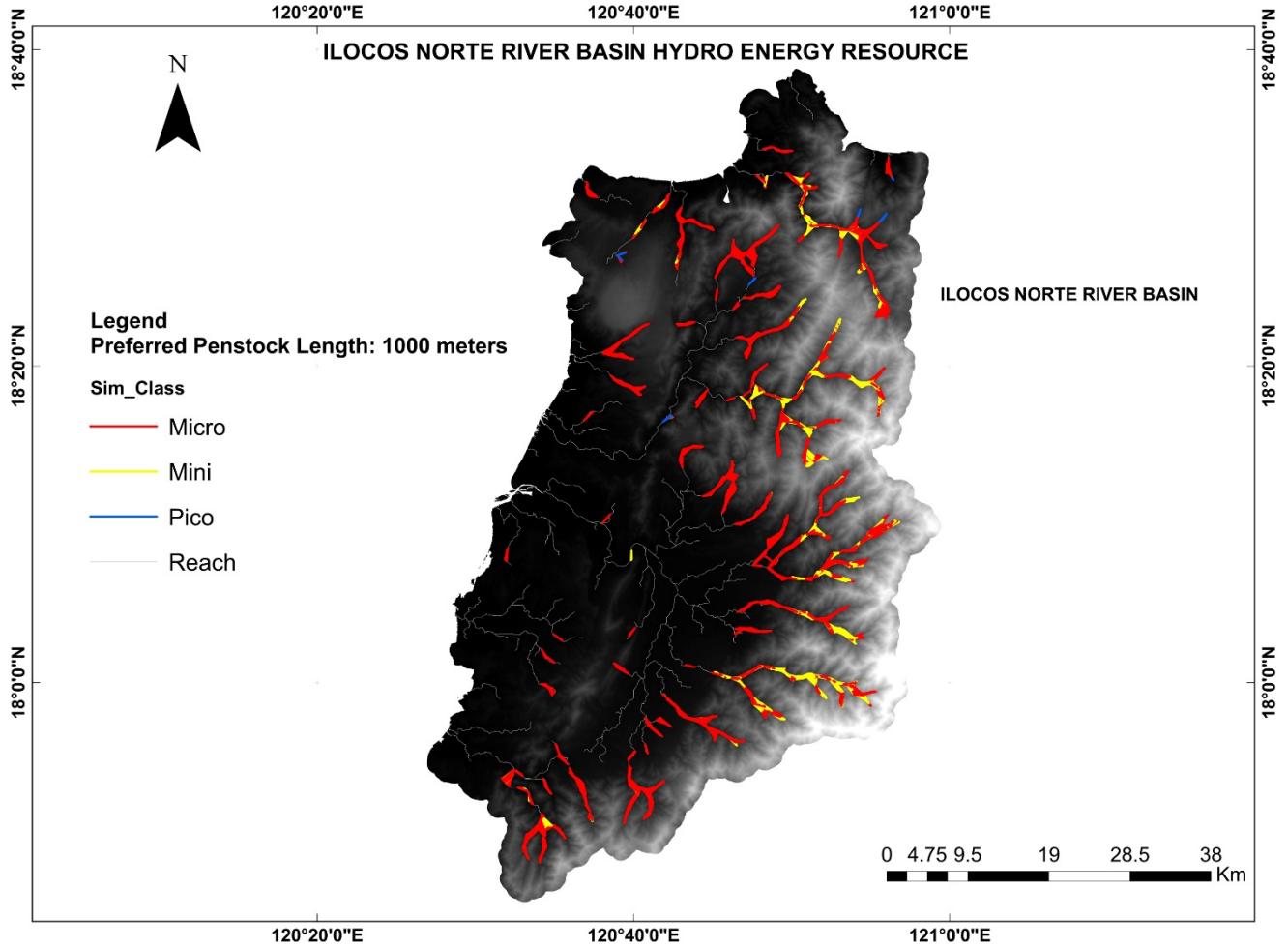
500 m Preferred Penstock length		
Power Distribution	**Count**	**Percentage**
Pico	180	0.94%
Micro	16779	87.38%
Mini	2244	11.69%
Minimum Simulated Power		2.42 kw
Maximum Simulated Power		576.18 kw



RESULTS

- Power Distribution

1000 m Preferred Penstock length		
Power Distribution	**Count**	**Percentage**
Pico	205	0.67%
Micro	21571	70.44%
Mini	8847	28.89%
Minimum Simulated Power		2.237 kw
Maximum Simulated Power		581.61 kw



CONCLUSION

The study was able to assess the hydro-energy resource potential of the Ilocos Norte river basin using SAR dataset and GIS technologies. Possible locations for the intake bay, penstock and powerhouse was also identified. Lengths of penstocks and head distance was integrated from the attribute of the shapefiles produced. The study was able to establish a model identifying locations for strong river flow with a suitable head in the river basin of the province of La Union. The identified sites was supported by the computed potential hydro-power and was labelled according to their classification.

CONCLUSION

The attribute table of the final feature contains the information for the highest modelled power generation capacity and can be used as a reference as to where a hydro-power plant could be built.

RECOMMENDATION

Site suitability assessment of the areas identified to have a potential hydro-energy resource for the establishment of hydro-power facilities must be further studied. Social and environmental impacts on the area where the potential hydro-generation sites must be taken into consideration. Impact of the identified location in possible establishment of irrigation systems for the benefit of local farmers should also be studied.

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