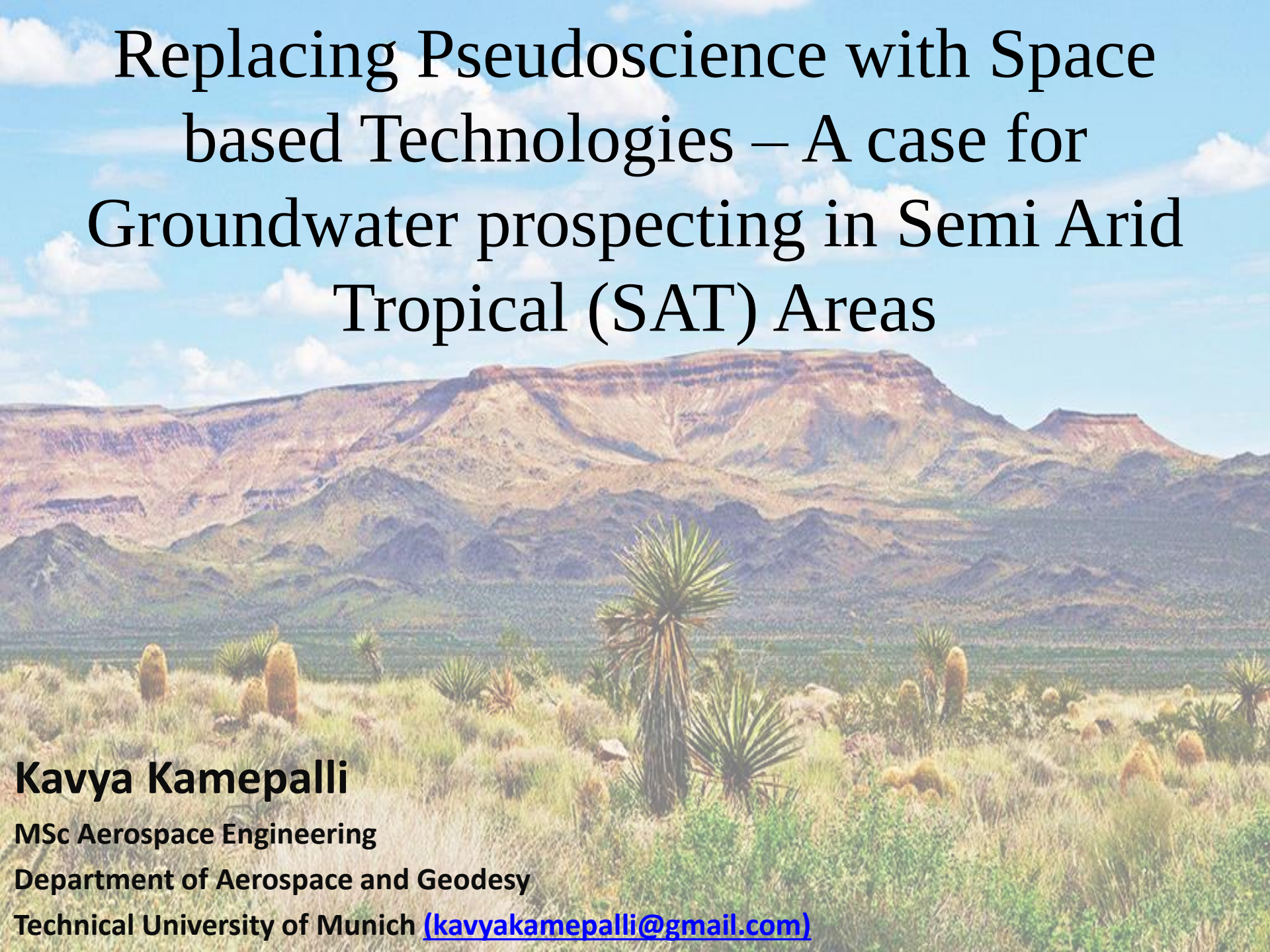
Replacing Pseudoscience with Space based Technologies – A case for Groundwater prospecting in Semi Arid Tropical (SAT) Areas



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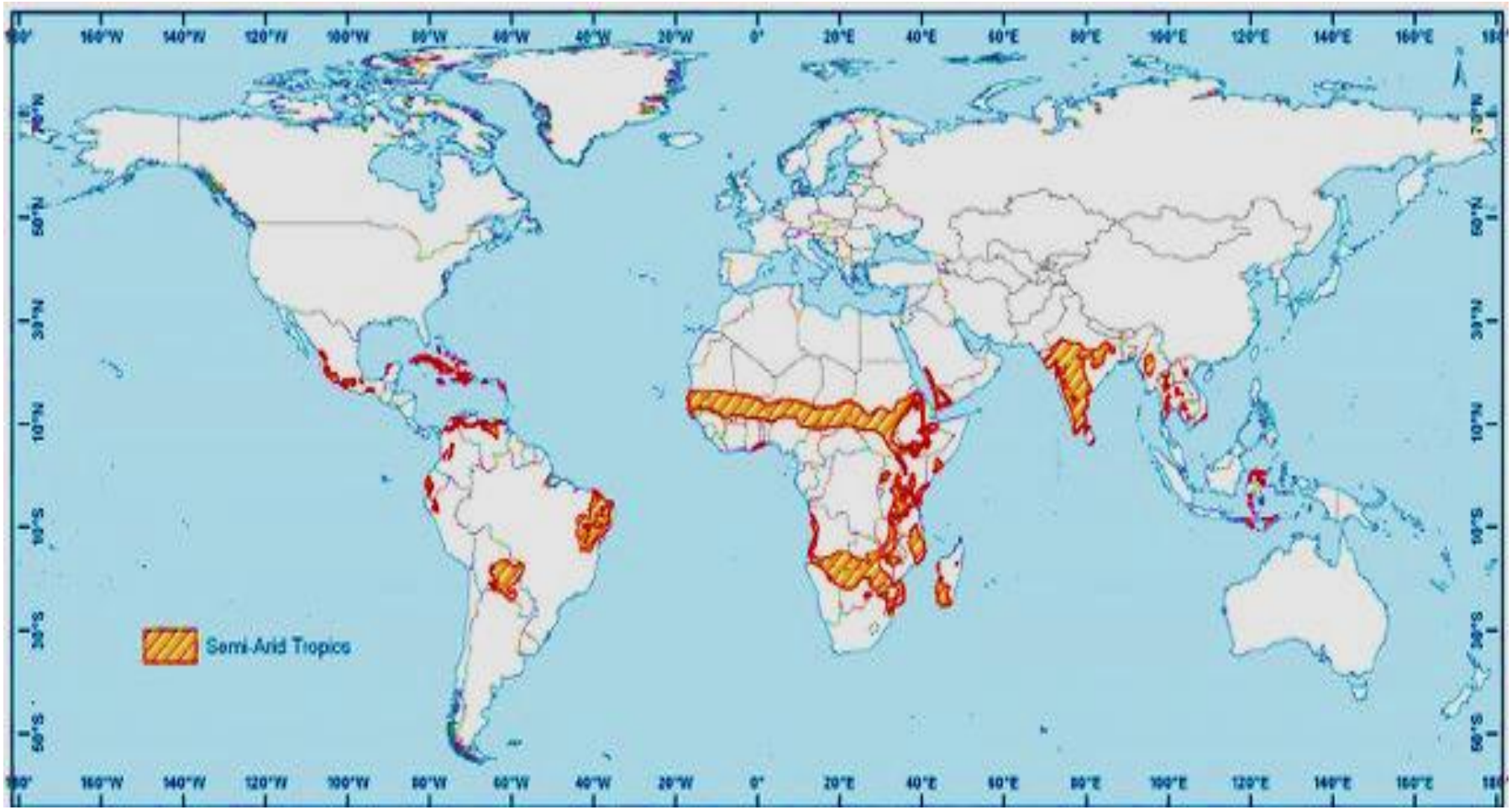
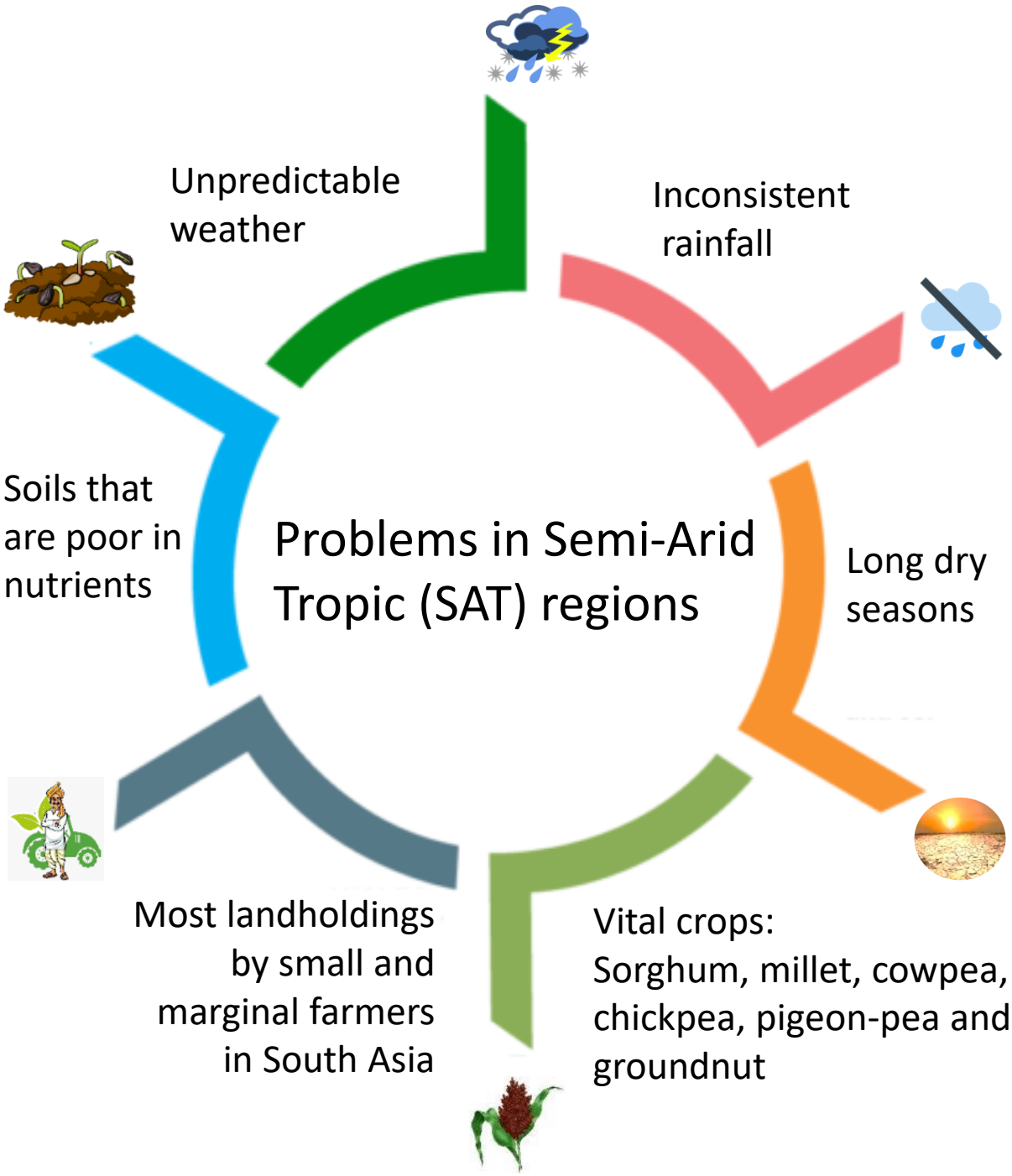
OUTLINE

- INTRODUCTION TO SEMI-ARID TROPICS (SATs)
- SEMI-ARID TROPICS (SATs) IN INDIA
- EXPLORING GROUNDWATER
- SPACE-BASED TECHNOLOGIES FOR GROUNDWATER DETECTION
- ASSISTING THE FARMERS AND GOVERNMENT WITH SBTs

GLOBAL SEMI ARID TROPICS





Water

- Elixir of life, a finite resource

- A major limiting factor in SAT

SAT IN THE INDIAN CONTEXT

- India occupies
  - Only 2.4% of the world's geographical area, home to about 16.7% of the world's population
  - Has only 0.5% of the world's grazing land but supports 18% of the world's cattle population

- 69% of the geographic area of the country is dry land (arid, semi-arid and dry sub-humid)
  - About 50.8 Mha land area (15.8%) is arid,
  - 123.4 Mha (37.6%) is semi-arid and
  - 54.1 Mha (16.5%) area falls in the dry sub-humid region

SATs IN THE INDIAN CONTEXT

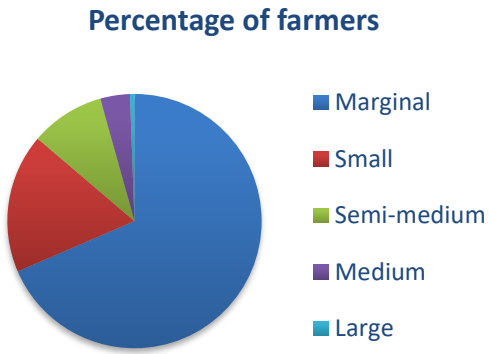
- Traditionally, water systems have been around the cascade of inter-connected tanks
- In the absence of perennial surface water sources like rivers, water management is crucial
- Over centuries, a tank based irrigation system evolved, incorporating access and allocations between and within tanks and also for tank upkeep
- For instance, the Karnataka state itself is dotted by 36,672 tanks with a potential command area of 685,000 ha

EXPLORING GROUNDWATER

- Surface Technologies
  - Geological
  - Geo-morphological
  - Hydro-geological
  - Geophysical methods
    - Electrical
    - Seismic
    - Magnetic
    - Gravity
  - Geo-botanical methods, geochemical methods

- Sub Surface Technologies
  - Geological
  - Hydrogeological
  - Tracer
  - Geophysical logging

LIMITING FACTORS – Marginal Landholdings



Category of Holdings	Number of Holdings (Year 2015-2016)
Marginal (Less than 1 hectare)	99,858 (68.52%)
Small (1 – 2 hectares)	25,777 (17.69%)
Semi-medium (2 – 4 hectares)	13,776 (9.45%)
Medium (4 – 10 hectares)	5485 (3.76%)
Large (10 hectares and above)	831 (0.57%)
All holdings	145,727 (100%)

Low income levels

High vulnerability to drought

Forced to seek advice about the ideal point for groundwater extraction through borewell

WATER DIVINER WITH COCONUT

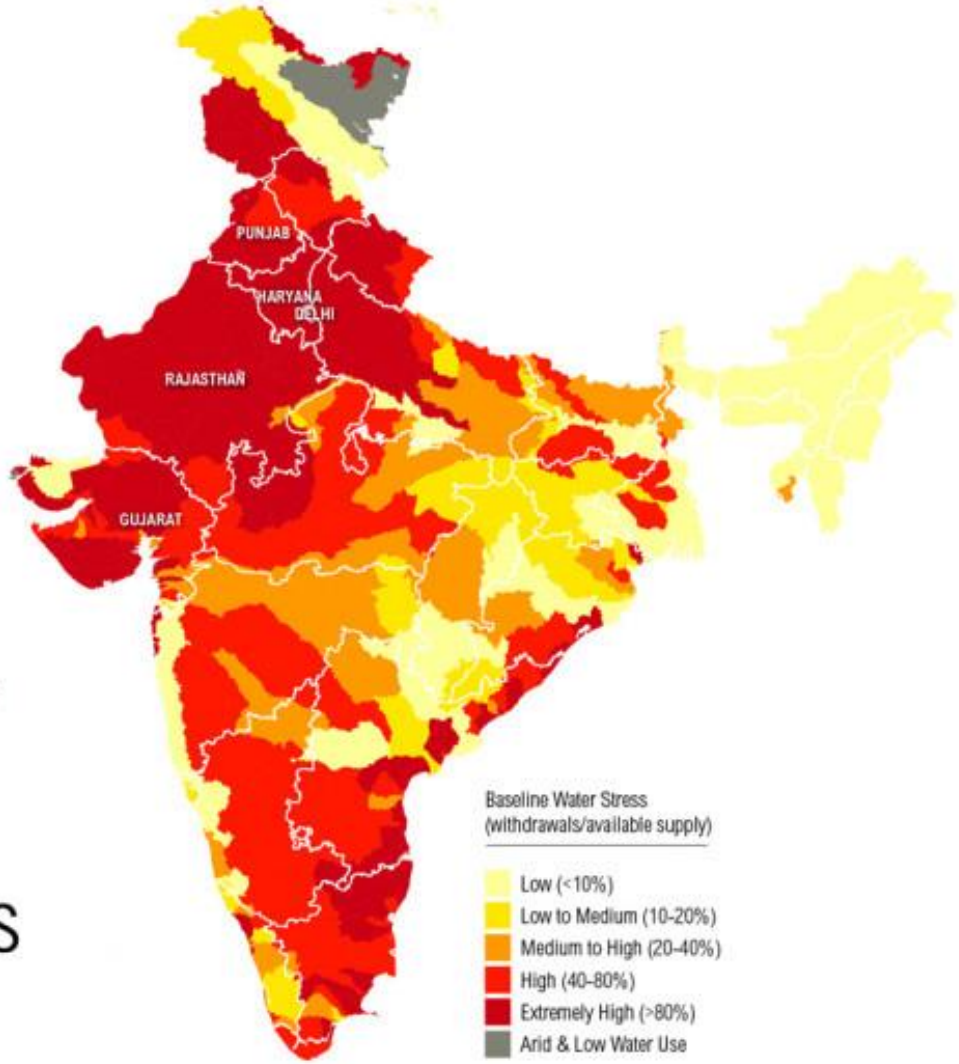
WATER DIVINER WITH CHAIN

WATER DIVING WITH TWO RODS

WATER DIVINER TWIG

UNWANTED REPERCUSSIONS!

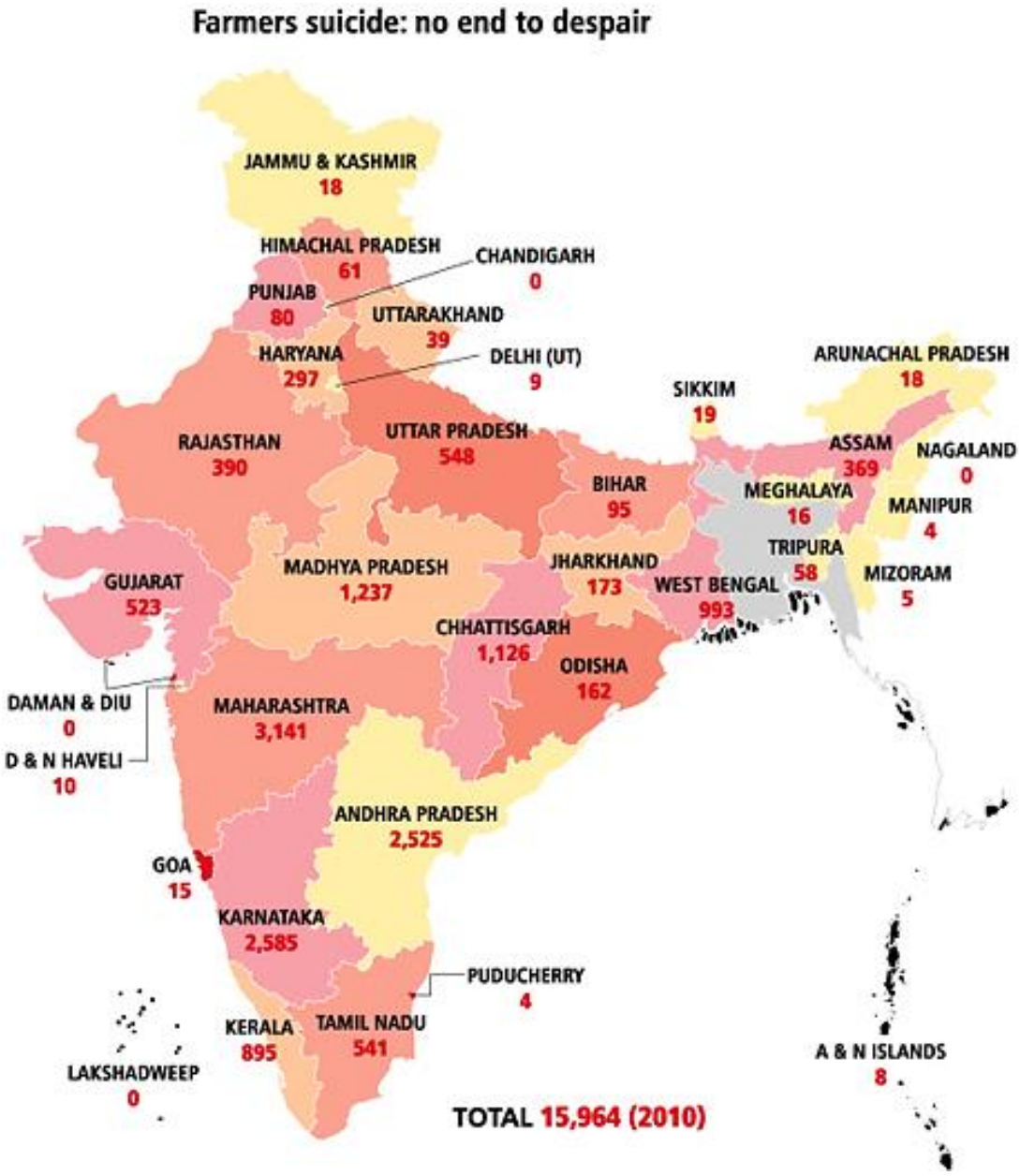
54%
of India
Faces
High to
Extremely
High
Water Stress



www.indiawatertool.in

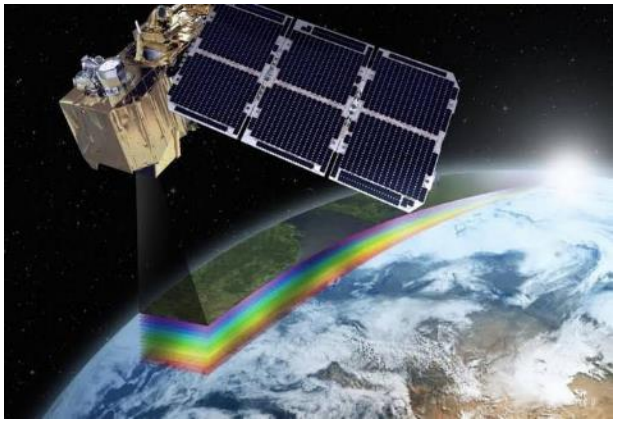
WORLD RESOURCES INSTITUTE

UNWANTED REPERCUSSIONS!



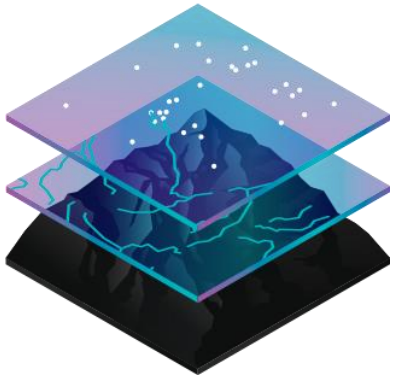
SPACE TECHNOLOGY – A Reliable Aid

REMOTE SENSING



- Rapid and cost-effective tool for detecting, extracting, conserving, and testing the vulnerability of groundwater across space and time

GIS / GPS



- Prepare thematic maps and delineate groundwater potential zones (GWPZs) and monitor groundwater vulnerability

DRONES (3rd generation of remote sensing)

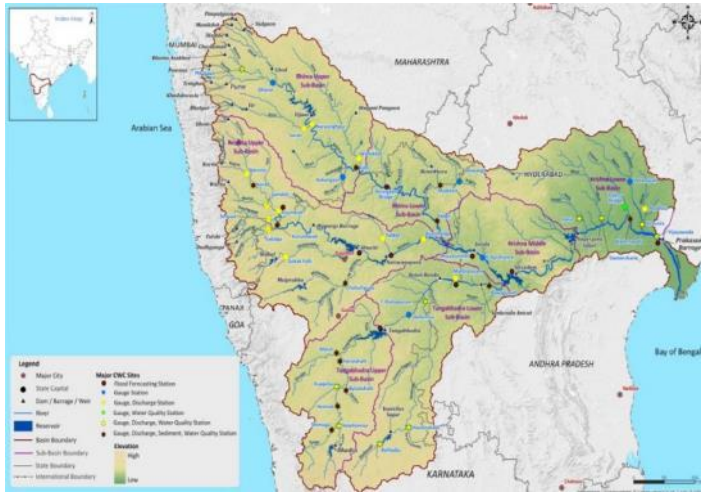
- Airborne sensors to collect wavelength data from objects on the ground. In photogrammetry, source light from the sun bounces off the target, which is collected by sensors on a UAV, manned aircraft, or satellite

LONG JOURNEY WITH SMALL STEPS …

- The National Remote Sensing Centre (NRSC), ISRO - Ground Water Prospect Maps (GWPMs)
- The possible ground water sources were delineated within the radius of 1.5 km covering for all habitations using IRS 1C, 1D and Resourcesat satellite data on 1:50,000 scale
- Web Enabled Water Resources Information System (India-WRIS) - All water resources data and information in a standardized national GIS framework
- Allows users to search, access, visualize, understand and analyze comprehensive and contextual water resources data for assessment, monitoring, planning, development and Integrated Water Resources Management

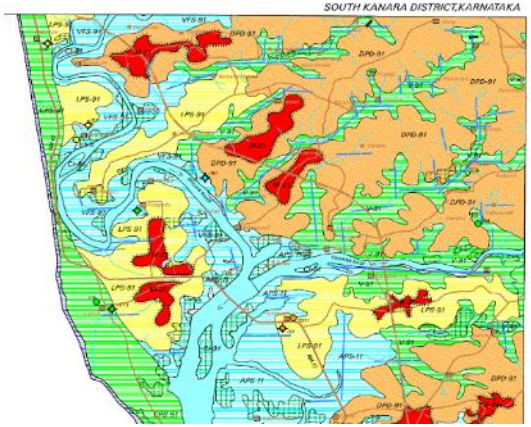
- Provides the required information on geological parameters connected to ground water exploration and the probable ground water prospects
- Narrows down the area of investigation for prolific selection of :
    - Sites for drilling
    - Planning recharge structures

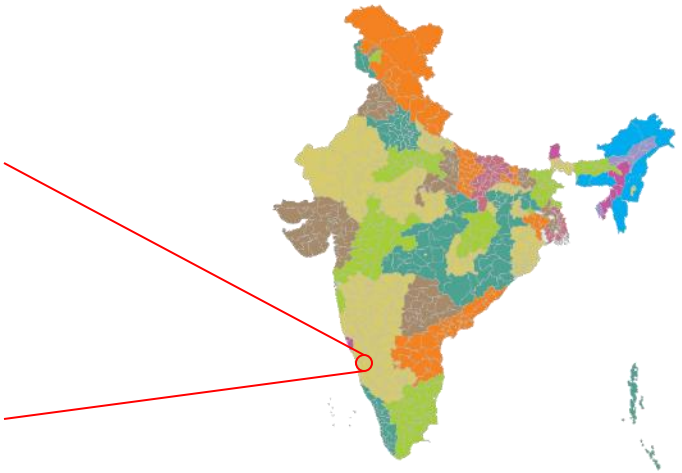
(ultimately addressing the irrigation and water problem in an effective manner)



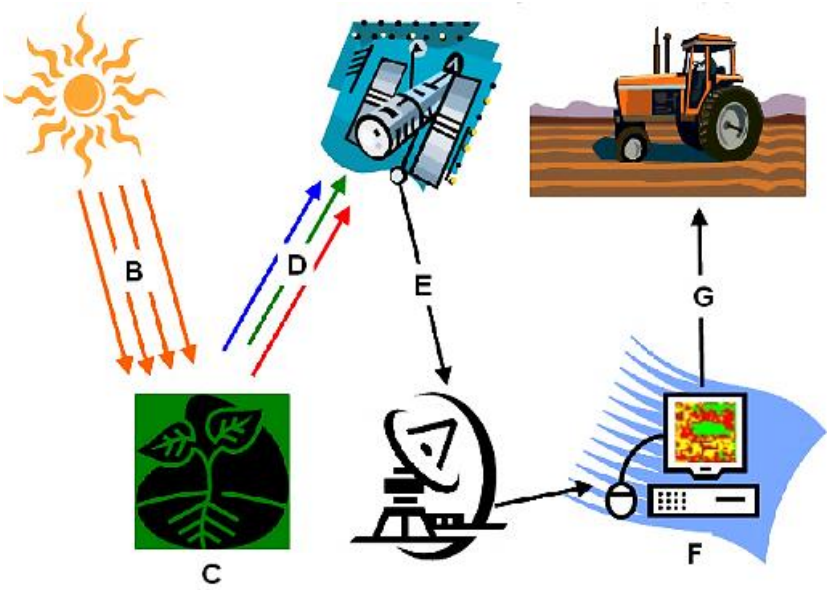
L E G E N D

MAP UNIT (HYDROGEOMORPHIC UNIT) REPRESENTED IN THE MAP WITH ALPHANUMERIC CODE (COLOUR INDICATES GROUND WATER PROSPECTS)	GEOLOGICAL SEQUENCE/ ROCK TYPE (REPRESENTED IN THE MAP WITH NUMERIC CODE)	GEOMORPHIC UNIT/LANDFORM (REPRESENTED IN THE MAP WITH ALPHABETIC CODE)	DEPTH TO WATER LEVEL SUMMER/PRE-MONSOON (AVERAGE IN METERS) / NO. OF WELLS OBSERVED	RECHARGE CONDITIONS BASED ON AVAILABILITY OF WATER (RAINFALL & OTHER SOURCES)	GROUND WATER PROSPECTS: AQUIFER MATERIAL (LS = LOOSE SEDIMENTS, PR = PERMEABLE ROCK, FIR = FISSURED ROCK, FR = FRACTURED ROCK, WR = WEATHERED ROCK, IR = IMPERVIOUS ROCK)	TYPE OF WELLS SUITABLE (DW = DUG WELL, RW = RING WELL, BW = BORE WELL, TW = TUBE WELL, DBW/DTW = DUG-CUM-BORE / TUBE WELL)	DEPTH RANGE OF WELLS (SUGGESTED) MIN - MAX (IN METRES)	YIELD RANGE OF WELLS (EXPECTED) (In LPM or m^3/ day)	HOMOGENEITY IN THE UNIT & SUCCESS RATE OF WELLS (PROBABILITY) VERY HIGH HIGH MODERATE LOW	QUALITY OF WATER POTABLE (P) NON-POTABLE (NP) (INDICATE REASONS IF NON-POTABLE)	GROUND WATER IRRIGATED AREA (APPROX., RANGE IN PERCENTAGE)	RECHARGE STRUCTURES SUITABLE & PRIORITY (PT = PERCOLATION TANK, CD = CHECK DAM, NB = NALA BUND, RW = RECHARGE WELL, DT = DESILTING OF TANK, RP = RECHARGE PIT)	REMARKS (PROBLEMS / LIMITATIONS)
BH-11	PALAEOCENE TO RECENT — ALLUVIUM (SAND DOMINANT) (11)	BEACH (BH)	No wells	Excellent	LS	RW/DW	< 10 mts	200-225 cum/day	Very high	P/NP	—	Not required	Not suitable for ground water development
APS-11	PALAEOCENE TO RECENT — ALLUVIUM (SAND DOMINANT) (11)	ALLUVIAL PLAIN SHALLOW (APS)	No wells	Very good	LS+WR	RW/DW	< 15 mts	150-170 cum/day	Very high	P	2-3	Not required	Area is mainly preferable for dug wells
B-21	PALAEOCENE TO RECENT — LATERITE (21)	BUTTE (B)	—	—	—	—	—	—	—	—	—	—	Run off zone
M-21	PALAEOCENE TO RECENT — LATERITE (21)	MESA (M)	—	—	—	—	—	—	—	—	—	—	Run off zone
CI-91		CHANNEL ISLAND (CI)	0,5 mts / 1 DW	Very good	LS+WR	RW/DW	< 15 mts	150-170 cum/day	Very high	P	1-2	Not required	Area is mainly preferable for dug wells





MOST IMPORTANTLY



- **Assisting the farmers** to identify potential areas for irrigation sources with the help of dissemination of information from SBTs to self, mainly through Smartphones (mobile application), Agriculture Extension Centers (locally known as Krishi Vigyan Kendra)
- This information can be utilized by the **Government Agencies** related to the Ground Water Developmental Activities and avoid overexploitation of one particular region

“ Realization of the Sustainable Development Goals…..”