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HOW FARMERS BENEFIT FROM INTEGRATION OF EO, METEOROLOGICAL, POSITIONING AND FIELD DATA IN AN ANALYTICS ENGINE – THE AGRI-GIS EXAMPLE OF S ODISHA, INDIA

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ABSTRACT

Today, space-based EO data, meteorological observations and positioning information, integrated with ground data and maps, plays an important role in bringing logical decision-making, intelligence and wisdom in society - even at grass-root level. World over, society is generating, referencing, archiving and using vast amount of time-stamped geographically referenced data sets – enabling the development of integrated solutions that benefits individual citizens, societies, nations and humanity, in general. Because of this large amounts of spatial data availability the science of Spatial Analytics is becoming highly prevalent and relevant.

The Centre for Spatial Analytics and Advanced GIS (C-SAG; www.csag.res.in) is developing an Agri-GIS - a suite of Spatial Analytics solutions based on EO images, meteorological data, Positioning data, various maps and different field data sets. The focus of the Agri-GIS is to address Smallholder Farmers – farm level aggregation and dis-aggregation of crop and socio-economic parameters; assess crop suitability of beneficiary land; assess crop-water model; help farmers on nutrition management; provide information on available production technologies, financing options, insurance options, access to inputs and market access etc. The strength of the C-SAG Agri-GIS model stems on a "single, common, standardized, integrated robust and reliable" multi-layered (about 304 parameters), spatially referenced and geo-tagged database – modelling for individual farmer's social, economic and natural resources queries. Out of the 304 parameters, space based inputs provide the critical 25% - mainly from near real-time EO images of various resolutions/receptivity and meteorological data. Another 20-30% of field observations are based on space-based Positioning - the rest are geo-tagged tables and records. Agri-GIS is developed in 613 villages of S Odisha in India and covers almost 80,000 farmers.

This Agri-GIS is an end-to-end solution that combines ground-, space-based EO/meteorological/positioning data into a GIS model to address specific farmer requirements at bettering his crop production and yield and also his economic condition by increased income. The paper will address how assessment of farmer's needs of information in the various farming communities in Odisha state was taken up, the chain of Spatial Analytics and the final deliverables of 5 Farmer Advisories in each crop season. The paper will also highlight the partnerships of C-SAG, Tata Trusts and the farming communities and how a good working relationships between various stakeholders have been developed for the project.

Keywords: Geographical Information System, EO Images, Farmers Advisory, Meteorological Data, Social Indexing, Economic Indexing

1. INTRODUCTION

Today, data and information play a significant role in bringing logical decision-making, intelligence and wisdom in society. In recent years, the "spatial character" of data and information is gaining prominence and greater significance.

Spatial data is generated in multitude of ways – through satellite measurements and imaging; through sensors on Unmanned Aerial Systems or aircrafts; embedded precise positioning using specialized hand-held devices; underground utilities data; indoor positions and mapping; mobile systems and Wi-Fi systems based on positions of transmitters; radio-frequency identification (RFID) using networks of fixed detectors/readers; laser imaging matched to 3D geometry and many, many more methods.

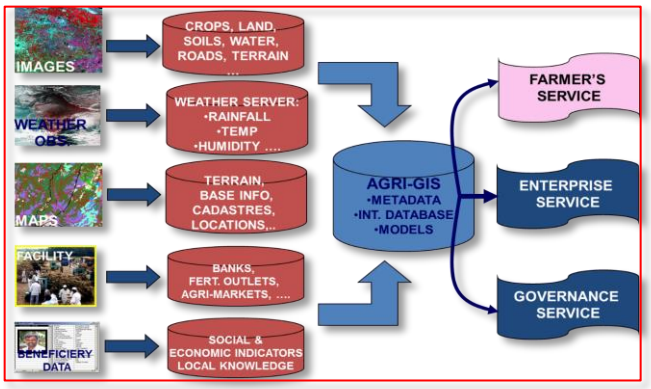
World over, society is generating, referencing, archiving and using vast amount of spatial data sets - of citizens, vehicles and automobiles, land, agriculture and crops, soils, cities, water systems, infrastructure, aviation and advanced transportation systems, environment, disasters, weather and many others. Maps and images are used in day-to-day actions of searching points of interest, routing, districting, property assessment, taxation, deciding government spend and many other daily needs. Spatial datasets are also getting "time-stamped" - making them amenable to change detection and time-analysis.

Spatial Analytics (SA) is the logical processing of such spatial data and information entities using their topological, geometric, or geographic properties and is emerging at the forefront of advanced Geographical Information Systems (GIS) knowledge. SA is also spurred by the increasing ability to capture and create geotagged data-rich environments. Combined with Internet-of-Things (IoT) and using Artificial Intelligence principles, SA is charting the future of geographical data processing in the Big-Data and Cloud environment.

Using advanced computational analysis, SA helps determine intrinsic geographic patterns – patterns of commonality, optimality, suitability, predictability etc and adopts advanced modeling and heuristics of self-learning principles for processing spatial datasets. SA helps definitions of "where"; metrics of distances/area/shape/ proximity/nearness etc; relationships between data by similarity; siting and locating analysis; spatial econometrics; aviation analytics; Spatial Decision Support Systems (SDSS) and simulations using interpolation methods. All of the characters of SA are oriented to "find patterns" and "newer meaning" and for predicting a FUTURE trend. SA can unravel hidden meanings.[1]

The Centre for Spatial Analytics and Advanced GIS (C-SAG; www.csag.res.in) is a premier institution that is involved in developing knowledge assets in SA and generating high-end capability in integrated data analytics to build solutions that are of direct societal relevance.

One of the works that C-SAG has taken up is to develop an Agriculture-GIS (Agri-GIS) - a suite of SA solutions based on integration of space-based EO images, meteorological data, positioning data, various maps, beneficiary data and different field data sets.



2. FARMER AS AN ECONOMIC UNIT

The benefit of the Agri-GIS should mainly accrue to farmers, at first beneficiary level, where farmers need to be supported with land, water, crop, market, pricing, social and empowering information – that can improve the farmers ability to grow more, grow right and be socially and economically empowered. The focus of the Agri-GIS is towards beneficiary farmers – specifically addressing smallholder farmers – farm level aggregation and dis-aggregation of crop and socio-economic parameters; assess crop suitability of beneficiary land; assess crop-water model; help farmers on nutrition management; provide information on available production technologies, financing options, insurance options, access to inputs and market access etc. Of course, the same Agri-GIS can also help other "stakeholders" – like governance policy-makers and non-government organisations.

We want to look at a "farmer" as a virtual "economic unit" – who generates certain level of

[1] Brochure of Centre for Spatial Analytics and Advanced GIS (C-SAG) - http://www.csag.res.in/site/wp-content/uploads/2017/10/C-SagBrochureSep2017-1.pdf

economy for his unit or family. Thus, the main aim we have set is to be able to undertake a 360-degree evaluation of a farmer – his land, his social characters, his economic status, his aspirational status etc and assess/advise on what efforts would improve his quality of life and increase his economic levels. We recognise that economic activity of farmer may come from cropping activity and many other non-cropping activity – animal husbandry, poultry, bee-keeping, other labor activities (like Rural Employment Guarantee scheme), crop waste disposal and many others. Much of his activities is a function of his social and economic backgrounds – including education/literacy, health, family demography etc. In addition, a farmer is also impacted by external environment – weather, markets and pricing, finance access, agricultural facilities access, policies and subsidies etc – these are also important to be included in GIS assessment. Thus, a holistic assessment of a farmer on all these direct and in-direct aspects will be very essential. This concept is central to our theme of Agri-GIS and Farmer's Advisory – which we feel would be moving away from the many other traditional advisories that look at just the land/soil aspect of cropping activity of a farmer.

3. AGRI-GIS MODEL

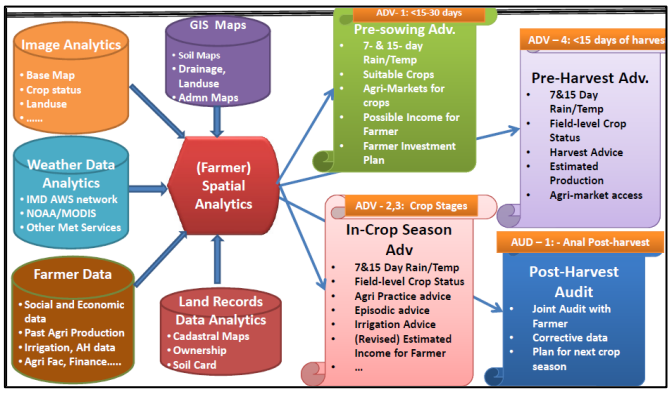
The initiative of Agri-GIS is to use SA and GIS to derive farmer advisories at PLOT-LEVEL and targeted at individual farmer as a beneficiary. Some of the analytics that we would employ would include real-time crop status analysis, crop suitability analysis, farmer social and economic indexing analysis, market linkage analysis for each farmer, farmer support indexing, in-crop season change analysis, hotspot analysis etc – the outputs from these analytics are then embedded into easy-to-understand farmer advisories.

To meet the 360-degree evaluation, we have identified and organised a range of data at unit of a PLOT-LEVEL – on natural resources of the land of the farmer, the agricultural practices, weather and meteorological data for cropping activity, access to agricultural facility, social condition of farmer-unit – in terms of simple indexing of demographic/working/income generating/cultural indexing; farmer economic status – in terms of indexing on his income levels, debt levels, ease of finance access, household facilities, broad aspirations mapping and other parameters. External environment data on "eco-system" that farmer-unit depends upon for his quality of life – real-time weather data access, agricultural facilities access, market access, finance access, consumption items access etc also become important.

In C-SAG model, we visualise that Agri-GIS database would be a collection of databases drawn from satellite images – crop status, land and water information; meteorological data – modelled to predict next 5-,7-,15-, 30 days meteorological information on rainfall/temp/humidity etc; cadastral base where every plot or survey number would be the fundamental unit with ownership details of each plot of land in legal records; household data – linked to each cadastre and having details of household owner and various social and economic data of household unit; various GIS maps of soils, landuse, GW potential etc which are more referential and linked maps to the S Odisha area; various agri "eco-system" data on facilities, market, finance etc. Yet another key element of the effort is that detailed field survey of farmer interaction data is being collected by Tata Trusts, through in-resident 600 village interventionists, who collect specific beneficiary data every year – in this way we have access to 3 years of detailed beneficiary data.

We are employing a unique method to organise these multiple layers and granularity of data and ultimately "dis-aggregate" all of them to a plot or cadastre unit in a unique GIS modelling exercise. Thus, all the multiple layers of data are reduced to plot-level and household linkages – thereby allowing integrated analytics to generate individual farmer advisories.

C-SAG has designed a 6-level Farmer Advisory template – pre-sowing (about 15-30 days prior to sowing season); 4 in-crop season advisories (broadly on monthly basis; episodic advisories would also be issued); pre-harvest advisory (~15 days prior to harvest) AND a post-harvest Auditing report (within 30 days of harvest mainly to undertake an internal audit and assessment of advisory effectiveness involving farmer).

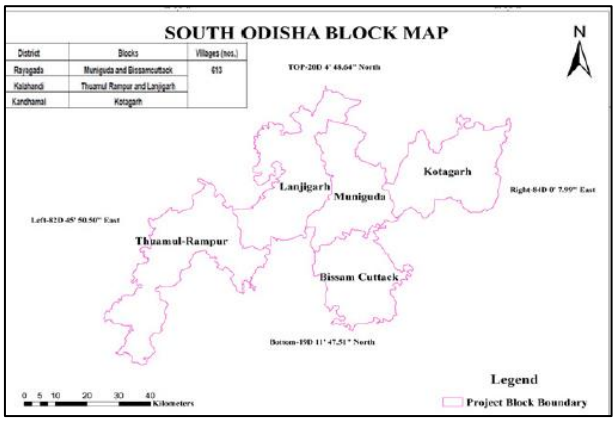


We have already designed the templates of the Farmer Advisories – and these were arrived at from a Workshop held at Orissa University of Agriculture and Technology, Bhubaneshwar on May 30, 2018. This

Workshop, attended by agriculture experts, SA and GIS experts, farmers from the region and many government and non-government organisations, discussed the Agri-GIS concept in detail and arrived at a template format for plot-level farmer advisory.

3.1 AGRI-GIS IMPLEMENTATION – SOUTH ODISHA, INDIA

613 villages in S Odisha have been identified for the Agri-GIS advisories – mainly because Tata Trusts have intervention programme in these 613 villages – in livelihood and NR domain. These 613 villages are in 3 districts – Rayagada, Kalahandi and Kandhamal. We have started with current 2018 Kharif and Rabi (Kharif and Rabi are 2 major crop seasons in India; Kharif season generally starts in June and extends till November; Rabi season starts in November and extends till April) as a start-up "Trial Run" of Farmers Advisories in 170 villages of S Odisha – which have been identified by Tata Trusts as they have intervention programmes in these villages.



We will continue in 2019 Kharif and Rabi as the 1st operational run of Farmer Advisories in 631 villages of S Odisha and finally in2020 Kharif and Rabi we hope to have the Final Operational run of Farmer Advisories in 631 villages of S Odisha. Subsequent to this – two decisions would have to be taken; one, on continuing Agri-GIS in S Odisha and up-scoping Agri-GIS, as required and two, how the Agri-GIS Knowledge Asset and intellect will be firmed up by C-SAG and Tata Trusts for state-wide usage.

4. INTEGRATION AND ANALYTICS OF VARIOUS DATA

The Agri-GIS database includes multi-parametric datasets from different sources – satellite imaging; satellite positioning; maps; field data; market data and other beneficiary data.

EO Images are one major element of Agri-GIS database. Today, diverse constellations of EO satellites are in operation – including, Landsat 7/8 from US, Radarsat of Canada, French SPOT/Pleiades; Indian IRS; Sentinel series from Europe as well as many Chinese, Russian and Japanese satellites. Apart from these, there are "swarms" of about 300+ small satellites of Planet, many satellites of Worldview and many other small satellites that orbit the planet collecting multi-band images of the earth's surface. All of these image the whole planet every day and are adding large volumes of data/images. It is estimated that several peta-bytes of data is collected every month and if one adds all the images/data collected in the world in last 10 years it is few exa-bytes of data volumes. Thus, there is no dirth or shortage of images of various resolutions and capabilities on real-time basis.

These large image collections are being driven by 2 goals – one, to create a temporal record of the Earth and its features that will help in environment, weather, climate change and scientific studies; two, to somehow instantly and rapidly meet the large demand of users who are ready to "pay and use" images/data/information at local levels of cities, infrastructure, farmers etc – say, millions of end-users that need locale-specific images/data/information on a constant basis. These 2-market demands are what is driving EO across the world – and also in India.

Thus, with the availability of images – map-making and GIS database has also received a great spur and today large volumes of GIS data is available in form of various maps – landuse maps, forest maps, city maps etc and are integrated with other traditional survey maps of cadastres, engineering surveys to "integrated geo-registered GIS databases of large areas". For example, Odisha itself has a good GIS databases of more than 300+ layers in Orissa Remote Sensing Applications Centre (ORSAC) – this is a great data asset.

Another important development is that Met data collections have been systematised and also digitalised and globally integrated. Thus, today India Meteorological Department (IMD) operates a high-standard network of weather stations that provide met data in telemetry mode. Apart from IMD, there are initiatives in private sector – IBMs Weather.com; Skymet etc that are undertaking weather data services and forecasting independently. These weather services from IMD and others are very important for national, state and other programmes – say, for example in the Agri-GIS that we are talking of.

4.1 OVERALL DATA CONTENT

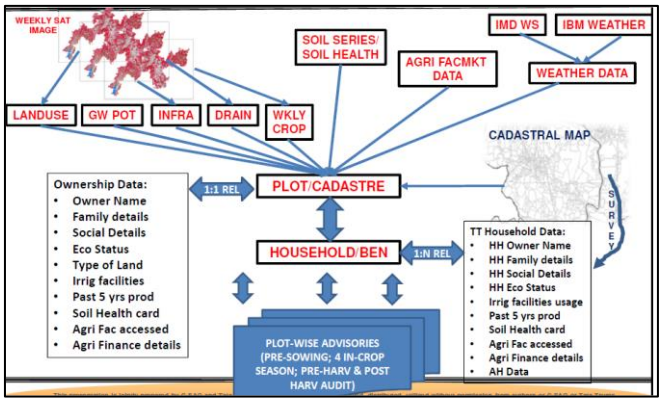
At a broad level, the Agri-GIS database includes the following:

- Every 3-5 days multi-spectral and SAR satellite images at various resolutions for crop assessment. We are accessing IRS images, Sentinel images, Landsat images and other high-resolution images.
- Cadastral data for all 631 villages with ownership details
- Soils data at Association or Series level. Aim is also to integrate plot-wise soil data as it gets collected.
- Basic topographic information
- GW Potential data analysed from satellite images
- Plot-wise Historical Crop data – survey number-wise for past 3-5 years
- Meteorological Forecasts from IMD and others – 3-day and 15 day forecasts.
- Real-time Weather data - temp/rainfall/winds etc at average daily/weekly/monthly
- Various thematic maps – landcover, surface water, vegetation cover, terrain slopes etc – from satellite images
- Socio-economic data - village-level census data
- Agri-Market data, Agri-facilities etc
- Beneficiary/farmer-level household data - social, economic status, agricultural etc

Tata Trusts has a customised field survey design application – PrimeSurvey – this has been used for Agri-GIS activity for filed level data collection on real-time basis. Detailed design of field survey parameters of farmer beneficiaries – including details on cadastral plot ownership, plot to tiller relationships, plot cropping details, plot soil and water details etc have been identified and thru PrimeSurvey, an App has been built that facilitates field-work force to collect data and ingest to Agri-GIS. The parameters include one-time survey parameters and also those that have to be collected multiple times in a crop season.

Various Mobile Apps have been developed for mapping of agriculture assets – like seed centres, fertiliser centres, banks, markets, extension centres etc and has been deployed in field to collect the assets; field-level crop mapper which collects crop data and crop pictures that are included in the analytics.

Such detailed datasets have been organised for the June-Nov Kharif 2018 crop season.



4.7 SPATIAL ANALYTICS FOR ADVISORIES

The following SA steps are adopted for deriving the Farmer Advisory at plot-level:

- Continuous Image Analytics for 631 villages in S Odisha for real-time information on crops and natural features. Both multi-spectral and SAR image back-scatter analytics have been used to differentiate crops and crop status at plot-level. 5-day repeat of Sentinel data and 16-day repeat of Landsat data are analysed to generate the land and crop information and are fused with cadastral maps – plot boundaries. Analytics for identification of cropped cadastral plots and non-crop plots based on back-scatter (for SAR) and NDVI analysis, supervised and un-supervised classification of satellite imagery for crop area identification is routinely undertaken in an automated manner.
- Access to IMD 3/5-day weather forecast data and the 15-day forecast from weather.com/IBM is routinely done. Detailed weather analytics have been generated to "dis-aggregate" weather data of temp/rainfall/humidity/winds to each village (and extrapolated to even plot level) level. These dis-aggregated data are used for plot-level Advisory generation. Various visualisation products from the weather forecast data and Forecast vs Actual weather comparative analysis has been undertaken for better modelling and understanding of forecast reliability.
- Social Indexing methodology has been developed that assigns and considers weightages based indexing of various social parameters of farmers data – his family demography, education status, income level, social characters, past data on agriculture etc. Social Index of each farmer has been generated that identifies the social separation of different farmers.
- Similarly, farmer-level Economic Indexing has also been undertaken that considers weights based past agricultural incomes; working members; other

economic activities etc. This Economic indexing helps analyse separation of different farmers from economic point of view.

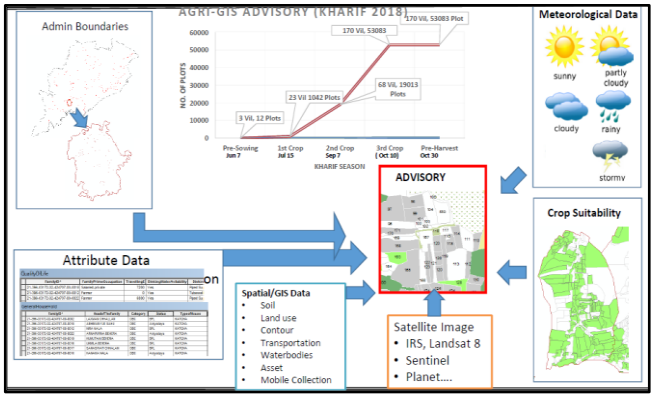
- Crop Suitability Analytics for each plot based on a multi-criterion GIS based integrated analysis that is based on soil, water, land and weather conditions. A classic Crop Suitability Model for paddy, maize, gram, pulses, groundnut etc has been generated.
- Finally, the analytics outputs are integrated into a step of Recommendation Analytics for generating the Farmer Advisory – including suitability of crops, best agricultural practices and possible income/investments that can be expected as an economic unit.

5. AGRI-GIS ADVISORIES

The Advisory content is quite detailed but is "dis-aggregated" to simple data units so that it can be easily understood – by farmers, by intermediaries, by extension workers etc. Pre-sowing and In-crop Season Advisory content are shown below:

• Plot ownership details • Plot characteristics - soil, irrigation • Weather forecast • Social Index - Education, marriage, children • Economic index - Agri Income, Non-Agri Income, motorcycle, mobile, tractor, TV etc • Crop Suitability • AH: Milch Cattle, Poultry, Bee-keeping, Lease - potential • Potential Income Estimate	• Plot ownership details • Crop grown • Crop Status • Weather forecast • Suggested Actions for Crop (Irrigation, Fertiliser, Pesticide etc.) • Potential Yield for plot area • Suggested Animal Husbandry Practice • Estimated AH output • Estimated Revenue (Crop, AH & Other) • Potential Income Estimate

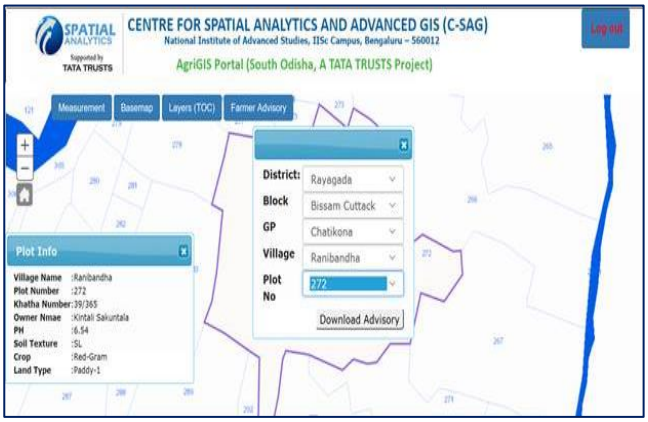
Trial Pre-Sowing Farmer Advisory for 12 farmers on trial and test basis was issued on June 7, 2018; 1st in-crop season Advisory has been generated for 1042 plots in 23 villages on August 7, 2018; 2nd in-crop season Advisory has been generated for ~19000 plots in 86 villages on September 10, 2018 – these have been disseminated to farmers on trial basis.



By the end of 2018 kharif crop season in November, 2018, it is planned to be able to issue Advisories for all ~80k farmers in 631 villages.

C-SAG has developed a GIS Portal and an Android/iOS App by which real-time Advisory can be accessed for each plot of farmer and details of crop status, weather data, crop suitability and/or agriculture practices, potential income expectation etc are available. This mode of access will better facilitate the access to the Advisory – while back-end the Analytics will be a regular activity to ingest Advisory inputs.

As an illustration, a sample Advisory is appended to this paper at the end, as shown below:



6. SPATIAL ANALYTICS – OBSERVATIONS

Based on the 2 Advisories that have been issued, some pertinent observations have been made for the S Odisha region – based on EO image analysis, meteorological forecasts, GIS analysis etc.

- The total area of S Odisha region in the 631 villages is 4348 sq kms – in 5 blocks of 3 districts. The region is mainly rain-fed agriculture and has agricultural and forest landcover as major categories. Cultivated agriculture land is about 1800 sq kms (forest area is ~1900 sq kms).
- Major crops grown in this region are paddy, millets, maize, pulses, oilseeds, commercial plantations, vegetables and very limited fruit-crops.
- Rainfall range in Odisha state is ~1450 mm during June to September period as monsoon. 75% of land-holdings depend upon agriculture that is rainfed.
- Land Holdings – land holdings are quite small and ranges from minimum of <.1 acre to maximum of 160 acres. About 25% landholdings are less than 1 acre and just 25% land holdings are larger than 5 acres (~0.5% is larger than 100 acres). Thus, very

small land-holdings pose a major problem for economic activity in agriculture. Tata Trusts engages with almost 50% of land holding beneficiaries and most of these are cultivated agriculture land.

- Physiography varies quite a bit - 15% of the agriculture lands are low lands; 62% are medium land and 23% are high lands. In Kharif season, about 75% of the land is brought under paddy cultivation.
- Literacy is quite average - ~40% literacy prevails and just ~15% have formal school education and above.
- Men head families in almost 86 % households but there are about 14% households that have females heading the families.
- Apart from engaging in farming activity, most families also undertake daily-wage and employment guarantee tasks to complement earnings and income. Thus, male members contribute major share in family income - 72% of the household income whereas female members contribute 28% of the income.
- From sampling analysis, it is seen that average Annual Income per Household is INR 32,000 (~<500USD). The Average Per Capita Annual Income is estimated to be INR 8,000 (~15USD).
- In 2018, rainfall in June-September has been on average levels – with high peaks of rainfall >250mm vs ~430mm (forecast vs actual) during fortnight of Aug 11-24, 2018. This period was a month after sowing – farmers were alerted and advised to take precautions of emerging crops at leafing stage from water impounding loss.
- Similarly, in the week of Sep 20-26, 2018, rainfall forecast was ~100mm and farmers were advised to protect the crops which were at stem-elongation stage.

The above analysis have been embedded into the Pre-sowing and 1st In-crop season Advisories that have been provided to the farmers.

Activities to provide the 3rd In-crop season Advisory during 1st week of October, 2018 are on-going – by which time the crops would be at flowering stage – a crucial stage for the crops and for farmers.

7. SOME CHALLENGES

There are some challenges too!! Availability of satellite images at the "right time" is a challenge – a challenge of acquisition, access and cost. We hope to address this with a cadence access of public-domain and commercial images for next 2 years.

Ability to autonomously obtain farmer's field data for each crop season and at various crop stages – especially the actual crop he has grown (farmers do not necessarily take the crop that is advised – there are many social and resources aspects that are considered and we have to factor it in to the Analytics model). Thus, if we could have a method by which a farmer by himself provides crop sown information to Agri-GIS is what has to be worked out – that is a challenge.

The land-holdings pose a challenge – sizes vary from a minimum of 0.1 acre to a maximum of 160 acres – an average land-holding size of ~1 acre in the area. Thus, small land-holdings poses difficulty to "dis-aggregate" data to a plot-level and also for undertaking image analytics using satellite images. The ideal is to use very high resolution images from satellites or Unmanned Aerial Systems (UAS). Suggesting better agri-practises and technology-based tilling in small land holdings also is a difficulty – the concepts of aggregated- or cooperative-farming has to be considered for such small land-holdings to optimise input resources and maximise returns to small farmers.

There is also a social practice of leasing a plot to many tillers – thereby making contract-farming at low-levels of return and subsistence. Such "un-official" allocations by land-owner also is a challenge for analytics as there are no data records of such divisions.

We are also challenged by how the advisories can be actually disseminated and communicated – in real-time so that farmers can derive benefit. We plan to employ a step-by-step approach – first, utilise the advantage as Tata Trusts field officials – a team of 600 "intermediaries" in field who could bridge for a one-on-one interaction with farmers. Another model is to use the Krishi Vigyan Kendra of OUAT Extension services for dissemination – a web-access of Advisory. A direct smartphone App access by farmers would be most ideal – but the telecom coverage and social conditions of farmers may not always allow for this – but over time this should get overcome!!

There is also the challenge of language-localisation to Odiya – we would address this in coming times.

The important challenge of up-scoping this also exists – how can larger areas and larger farmer base be covered. The Agri-GIS model is dependent on 2 "possible constraining" factors – getting farmer's plot data ingest autonomously AND direct access of the Advisory by farmers. Rest of the analytical problems – image analytics, met analytics, dis-aggregated GIS

analysis, indexing analysis and Advisory generation are not limiting factors and are easily up-scalable.

As we move into each crop season of 2019 and 2020, we are optimistic of overcoming most of these challenges.

8. CONCLUSION

Future of Spatial Analytics is in integration of variety of data – packaging EO images, positioning services and communications, GIS maps, field data, text data, video and images – all woven into an analytics system that addresses the specific questions and problems of society – here we are demonstrating of how farmers can benefit.

Beneficiary, communities and governance solutions can best be addressed when an analytics of "information package" can provide decision-alternatives. Such a capability of reaching space products to the last-mile is the future that C-SAG works upon and we expect large number of such integrated SA systems to emerge to cater to large number of solution needs of humanity. That is the future that technology – in particular space technology, integrated with many others will progress in future.

Through Agri-GIS, space products and SA tools can become a part and parcel of farmers good-governance and bring benefit of quality of life by bettering the farming and income activities of farmers.

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There are also a body of experts in GIS and Agriculture Extension that C-SAG works with and such engagements have immensely contributed in the definition and implementation of Agri-GIS – it is difficult to mention all of them but the authors wish to acknowledge the "thought-body" of these experts that have been involved and contributed.

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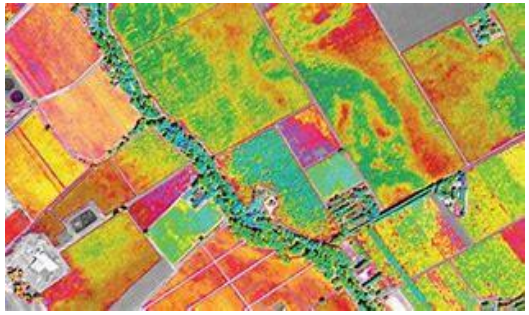


2nd IN-CROP SEASON ADVISORY - KHARIF 2018

3rd TRIAL ADVISORY

CENTRE FOR SPATIAL ANALYTICS AND ADVANCED GIS (C-SAG), BENGALURU
AND
TATA TRUSTS, BHUBANESHWAR

CENTRE FOR SPATIAL ANALYTICS AND ADVANCED GIS (C-SAG)
AND
TATA TRUSTS

C-SAG AGRI-GIS FARMER'S ADVISORY (IN-CROP SEASON-2) – Kharif 2018

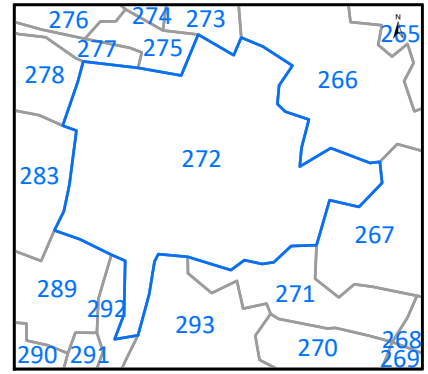
3rd TRIAL ADVISORY

Date of Advisory: 10/09/2018 **Farmer's Mobile:** NA

A. PLOT AND FARMER DETAILS

Plot No.	Khata No.	Plot Area (in acres)	Plot Owner Name	Tiller Name
272	39/365	2.13	Kintali Sakuntala	Kintali Sakuntala

Village	Village Census Code	Gram Panchayat	Block	District
Ranibandha	425311	Chatikona	Bissam Cuttack	Rayagada



B. PLOT'S NATURAL RESOURCES CHARACTERISTICS

• Land type (Plain/hilly/upland/midland/lowland)	Paddy-1
• Slope (Gentle/Moderate/Steep/Very Steep)	Moderate
• Soil Type	SL
• Soil Depth	13
• Soil pH Value	6.54
• Soil Nutrient Status	NA
• Irrigation Source (Rainfed/Bore Well/Tank /Canal)	Rainfed

C. FARMER'S SOCIAL AND ECONOMIC INDEX (scale: 1=very low.... 10=very high)

• Farmer's Social Index	5.072727
• Social Description	Average Social Constraint
• Farmer's Economic Index	1
• Economic Description	Very Low Social Constraint

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3rd TRIAL ADVISORY

D. DATE OF WEATHER FORECAST*

D1 6 DAYS FORECAST (BLOCKWISE) made available from IMD

Date (DD-MM-YYYY)	Min. Temp. (ºC)	Max. Temp. (ºC)	Rainfall Probability (%)	Rainfall (mm)	Relative Humidity (%)	Wind Velocity (kmph)	Wind Direction (deg)
10-09-2018	23.2	30.6	NA	0.3	84	3	296
11-09-2018	23.2	30.8	NA	56.8	89	3	292
12-09-2018	23.2	31.4	NA	41.7	91	6	283
13-09-2018	22.8	32.7	NA	11.4	87	9	283
14-09-2018	22.1	31.3	NA	3.9	80	8	291
15-09-2018	22.6	31.2	NA	0	76	7	295

***Weather Advisory – Specific Recommendations:**

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3rd TRIAL ADVISORY

D2 15 DAYS FORECAST (PLOTWISE) made available from IBM's The Weather Channel

Date (DD-MM-YYYY)	Min. Temp. (º C)	Max. Temp. (º C)	Rainfall Probability (%)	Rainfall (mm	Relative Humidity (%)	Wind Velocity (kmph)	Wind Direction (deg)
10-09-2018	22	30	80	11.34	81	3	79
11-09-2018	22	31	80	4.49	77	5	325
12-09-2018	22	32	20	0	73	7	317
13-09-2018	22	32	10	0	72	8	307
14-09-2018	22	31	40	2.72	73	6	357
15-09-2018	22	30	80	5.13	80	7	16
16-09-2018	22	30	80	9.1	83	6	25
17-09-2018	22	30	80	6.71	82	8	16
18-09-2018	22	30	50	1.32	78	9	17
19-09-2018	22	30	50	5.96	76	8	27
20-09-2018	22	30	80	7.44	79	5	53
21-09-2018	22	30	80	7.54	82	5	67
22-09-2018	22	30	80	7.02	83	5	88
23-09-2018	22	30	80	6.43	84	5	96
24-09-2018	22	30	80	5.15	83	6	103

C-SAG AGRI-GIS FARMER'S ADVISORY (IN-CROP SEASON-2) – Kharif 2018

3rd TRIAL ADVISORY

E. IN CROP SEASON CROP ADVISORY

Crop in Plot	Crop Status	Suggested Actions for Crop (Irrigation, Fertiliser etc.)	Estimated input cost (Rs.)	Potential Production for Plot Area (in ton per Ha)	Market price for potential production (per ton)	Estimated Revenue (Rs.)
Red-Gram	Good	Please refer recommended agricultural practice	NA	1.65	54500	89986

Recommended Agricultural Practice:

Agricultural Practice: Optimum moisture is necessary during (a) budding (b) flowering and (c) pod formation stages

Micronutrients application based on soil test report: NA

Compost/ FYM(Ton.): 2

Control of early shoot borer: Spray Mancozeb 0.1kg/acre

First weeding: Hand weedings once about 25- 30 days and another about 45- 50 days after sowing the crop

Gap filling (cm): 45- 60 x 20

Top dressing urea: The recommended doses of fertilizers are 8 kg of N and 16 kg of P2 O5 and 8 kg of K2O per acre.

Incorporation of green manure crop: 15 Kg N and 45 Kg P2O5 per hectare is sufficient for this crop.

Second irrigation: Optimum moisture is necessary during (a) budding (b) flowering and (c) pod formation stages

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3rd TRIAL ADVISORY

F. AH ADVISORY

Animal Husbandry	Number	Suggested Animal Husbandry Practice	Estimated Output	Estimated input cost (Rs.)	Unit price (Rs.)	Estimated Revenue (Rs.)
Cows	2	NA	NA	NA	NA	NA
OX	0	NA	NA	NA	NA	NA
Buffalo	0	NA	NA	NA	NA	NA
Goat	1	NA	NA	NA	2600	2600
Poultry	13	NA	NA	NA	100	1300

AH - Specific Recommendations:

G. OTHER ADVISORY

Other Activities	Description	Period of Activity	Estimated Revenue (Rs.)
Work Force	NA	NA	NA
Facilities Hiring	NA	NA	NA
Family Skill work	NA	NA	NA

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H. INTEGRATED INCOME ADVISORY

Estimated Income from Crop Activity (Rs.)	Estimated Income from AH Activity (Rs.)	Estimated Income from other activities (Rs.)	Estimated Total Income (Rs.)
89986	3900	NA	93886

Other General Recommendations:
NA

Advisory Control No: 2018/K/03/05229

Advisory Generated Date: 10 Sep 2018

Advisory Issue Date: 10 Sep 2018

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