weathersecure®

: advanced weather risk management platform for global insurers, reinsurers and agricultural businesses

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GLOBAL RESEARCH CENTER
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Indian Institute of Technology
Kanpur 208 016 India
We are a global climate risk management company innovating with **Big Data, Analytics, Smart Devices & Financial Services** for clients around the world.

**Founded**
2004

**Global Team**
150 scientists, engineers & mavericks

**Investors**
- ILO / SIDBI / IIT
- Ford Foundation

**Footprint**
- Pan India & Global

**Asia**
- Philippines
- Bangladesh
- Cambodia
- Sri Lanka

**Africa**
- Tanzania
- Rwanda
- Zambia
- Mozambique

**Latin America**
- United States
- Mexico
- Colombia

Our vision is to **secure smiles®** for all of us using pioneering new **analysis, technology and innovation** to provide security against climate change.
For Insurers and Reinsurers –

WeatherSecure is a solution for pricing and analyzing risks in crop insurance products and for monitoring claims

Weather Index based Insurance

Yield Index Based Insurance
- Yields collected from sample crop cutting experiments
- Yield through satellite observations

Farm level products including Multiple Peril Crop Insurance (MPCI)

Hybrid Products that combine weather, satellite based Indices and actual yields

For Agri Businesses –

WeatherSecure helps in

Risk Analysis
- Weather Events that can cause losses - frequency and severity - on yield and quality
- Impact of weather forecasts on yield
- Disease forecasting, probability and severity
- Impact of Climate Change

Production management decisions e.g.
- What is the right sowing window?
- Analyze water requirement for the crop period using past historical data and seasonal forecasts
1 Pricing & Contract Design
- Clean multi source original and synthetic datasets
- Robust Pricing Platform for weather and yield insurance products
- Can evaluate and price all term sheets currently offered globally
- MNAIS/MPCI pricing tool includes ability to forecast and back-cast yield

2 Portfolio Assessment
- Portfolio Analytics including Detrending, Multi Step Regression, Anova, Time Series and Parametric Distribution Fitting
- Portfolio Sensitivity Analysis Delta calculation on weather, yield and other parameters
- GIS Display of risk accumulation
- Integrated Term Sheet Reinsurers can integrate portfolio of multiple companies

3 Real Time Claims Assessment
- Daily observations from over 15000 ground stations for claims tracking
- Locations without weather station are tracked using satellite data
- Yield monitoring using NDVI Index and ground surveys
- Aggregate portfolio claims can be tracked actively
Insurance & Reinsurance Decision Making

Accuracy of insurance calculations
Quality of underlying data
Factors impacting yield
Accuracy of Portfolio PML
Risk Timeline and Value

Loss Cost Summaries
Underlying Data
Non Data Factors
PML Estimation
AS IS LOSS Situation

Industry 1st pricing tool
Direct DATA VIEW
Expert Team of risk analysts
GIS integrated PML analysis & area estimate
Managed data network

Pre-fed term sheets
Large multi source weather database cleaned using meteorology software
Strong Onsite survey and assessment capability
Statistical Analysis for fat tail estimate
Estimation using NDVI and other proxies

Quick AS IS turnaround
Robust climate data sets
Robust Capabilities for Agri Business

→ The **WeatherSecure accuyield®** module is a robust and mature crop yield forecasting facility with the capability to use seasonal forecasts and find dependencies on weather – soil – irrigation – technology.

→ It includes an advanced disease management and forecasting module that can draw on insights for **over 100 pests and diseases**.

→ Industry leading **Risk Analysis / Sowing Window Analysis / Irrigation Requirement Analysis** and **Estimate Insurance Premium**

<table>
<thead>
<tr>
<th>Onsite Services</th>
<th>Leaf Sampling &amp; Crop Inspections</th>
<th>Water Analysis</th>
<th>Water reclamation practices, Irrigation quality assessment, scheduling and fertigation.</th>
</tr>
</thead>
<tbody>
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<td>Nutrient Deficiency, Pest and Herbicidal effect on crops, Pathology and Residual Diagnosis for integrated crop protection</td>
<td>Water Analysis</td>
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<tr>
<td><strong>Soil Chemical Mapping at Field Level</strong></td>
<td><strong>Yield Data Interpretations</strong></td>
<td><strong>Estimation of potential yield, as well as spatial / temporal distribution of crop yield</strong></td>
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<td>Optimum decision on crop/fertilizer management, best soil reclamation practice and optimum use of</td>
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<tr>
<th>Soil Potential for variability management</th>
<th>Zone Management for VRT fertilizing</th>
<th>Tillage &amp; Fertilizer Recommendation</th>
<th>Effective Root Depth</th>
<th>Water Capacity</th>
</tr>
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<tbody>
<tr>
<td>Satellite Imagery</td>
<td>NDVI</td>
<td>Vegetative Index for geographical location</td>
<td>Drainage Evaluation</td>
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</table>
Weathersecure®

→ A robust and intelligent **Historical Data Manager** contains historical weather parametric data for each and every state of India. The HDM is a secure, mature and transparent tool available to all our clients.

→ Clients can access weather data securely and use tools to upload data and identify errors. The **Weathersecure HDM®** uses dedicated modules for data cleaning and comparison with nearby locations.

Robust statistical capabilities:

→ Homogeneity and Stationarity
→ Double mass curve analysis
→ Time series analysis
→ Temporal / Spatial interpolation
→ The WeatherSecure PDA® is a robust **Product Development Application** for Weather & Crop Insurance Products.

→ Allows de-trending, VAR Distribution fitting as well as Normal, Lognormal & Gamma.

→ Users can make diverse term sheets and complete **over 95%** of the termsheet using the application.

→ Up to **50 locations** can be priced in a single term sheet. Users can use goodness of fit and return on capital rate for pricing.
The WeatherSecure Portfolio Builder® can build multiple portfolios based on weights or sales scenarios and can seamlessly execute VAR Distribution fitting & de-trending on Portfolio payoffs.

Portfolio is automatically updated for any change in individual term sheets. Tools allows easy additions and deletions in the portfolio and can display both basic and advanced Portfolio Statistics.

GIS Display / displays portfolio locations with PML distribution in GIS. Includes acreage, structure detail and historical index for locations

Delta Calculation / on weather, yield and other parameters

Analysis on GFS forecasts / Sensitivity to geographical concentration. Gamma, Theta and VOL analysis.
An integrated yield estimation model adopting advanced remote sensing imagery, geographical information and appropriate statistical methodologies such as multivariate regression.
### YIELD MONITORING: In Season Crop Damage / Loss Yield

#### Dividing crop period into stages

**Vegetative**: Count of consecutive unfolded leaves, until the reproductive parts are visible  
**Reproductive**: As soon as flowers/tuber/ear head are visible until all kernels/seed/tuber are physiologically mature

#### Damage based on parts of the crop

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<th>Damage Type</th>
<th>Description</th>
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<tr>
<td><strong>Crop Stand Damage</strong></td>
<td>Count or % of crop stand area with no living axils/buds</td>
</tr>
<tr>
<td><strong>Crop Stem Damage</strong></td>
<td>Count or % of crop stem snapped off with inability to yield or inactive</td>
</tr>
<tr>
<td><strong>Branch Damage</strong></td>
<td>Position and % of branches snapped off or damaged</td>
</tr>
<tr>
<td><strong>Leaf Damage</strong></td>
<td>Count and % of leaves snapped off, shredded, de-colorized and inactive</td>
</tr>
<tr>
<td><strong>Ear / Pod / Head / Boll Damage</strong></td>
<td>Count and % of yield part knocked off / chaffed / shriveled/broken or disease/pest infected</td>
</tr>
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#### Fruit Damage

Count and % of fruits/tree knocked off/malformed/disease/pest infected

#### Crop Yield estimation before Harvest

Locating representative sample area. Determining plant stand, row width & density (plant/ear/fruit/pod) sample population/100 m². Estimating yield based on observations.

### Forecast Yield

\[ Y = F(\text{Seed Weight} / \text{Plants} / \text{Row Width} / ... ) \]

### Yield Loss

Normal Yield – Forecast Yield
YIELD MONITORING: UAV

- Object based hierarchical image analysis to classify imagery of plots
- Measured concurrently on the ground using standard rangeland monitoring procedure
- Objects are further classified into vegetative groups and to species level by Rule Based Classification.
- Well defined thresholds and Near Neighbor Classification Algorithm is feasible.
- Use of spectral camera to enhance results and assessment.
YIELD MONITORING: Videography & Smartphone
Inundation Status and Yield Estimation

→ Monitor Yields through Satellite images from LISS4, LANDSA and SAR

→ LANDSAT images of **30m x 30m** resolution. For more detailed analysis, LISS4 images of **5m x 5m** resolution.

→ Where visibility is affected due to clouds, Microwave SAR data is used.
Automated Weather Stations ➔

- India
  - Largest Private Network
  - Designed & Manufactured in IMD & ISO certified facility
  - Dashboard & Services Integrated

- Asia
  - Philippines
  - Cambodia
  - Bangladesh
  - Sri Lanka

- Africa
  - Tanzania
  - Rwanda
  - Zambia
  - Mozambique

- Algorithms to check consistency and quality of data
- Regular monitoring by a team of meteorologists
The **WeatherSecure Claims Manager®** is a real-time claims monitoring and assessment solution for both Weather and Crop Insurance.

- Dedicated modules allow seamless **GIS mapping** of claims.
- Users can execute comparison with claims in adjacent weather stations. The platform allows **Real Time Monitoring** if data is updated dynamically.
- Claim sheets can be exported in MS Excel for regulatory submissions.
**Cholamandalam** is a leading Indian general insurance company. In 2011 Weather Risk was hired to help structure Weather and Yield Index based **Crop Insurance Products**.

<table>
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<tr>
<th>Business Case</th>
<th>What we did</th>
<th>Impact</th>
</tr>
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</table>
| Cholamandalam wanted to establish a robust Crop Insurance Products portfolio | • WRL helped to structure Weather and Yield Index based products as well as advised Cholamandalam to manage its Crop Insurance portfolio.  
• We helped to build necessary banking channels for sales and distribution.  
• WRL also installed Weather Stations and conducted claim settling audits. | • Cholamandalam generated a premium income of US $ 20m in FY 13 – 14.  
• The portfolio covers 20000 farmers in Bihar and Rajasthan.  
• WRL continues to help Cholamandalam target US $40 m in 2014 – 15. |
Since 2007 we have helped ICICI Lombard implement a joint nationwide weather and agriculture Insurance market making and strategic development exercise.

**Business Case**

**What we did**

- WRL embarked on an exercise to remove technological, policy level and reinsurance capacity bottlenecks.
- WRL developed low cost weather stations, unmanned aerial vehicles, and automated yield measurement instruments to facilitate claim settlement.
- WRL also pursued the Ministry of Agriculture for subsidy support.

**Impact**

- The Ministry kindly consented in 2007 and granted support to Weather Insurance Products.
- In Rabi 2009 - 10 season WRL covered close to 4000 farmers for 10000 acres in just 2 districts of West Bengal.
Late Blight is a lethal potato disease. In 2006 PepsiCo contract farmers lost 60% of their crops due to this bane. We helped PepsiCo provide risk management to over 10000 farmers in Punjab.

**Business Case**

**What we did**

- WRL worked with the PepsiCo ground team in Punjab.
- Our analysis indicated high correlations with location humidity and temperature.
- We created an index to cover blight risk specific to the region.
- Additional weather stations were installed to minimize basic risk – critical for extending this kind of cover.

**Impact**

- Program successfully running in its 9th year.
- Covers 10000 potato farmers in Punjab.
- Strong demonstration of how insurance can be used by contract farming companies to sustain their grower base.
We have helped Bayer face the challenge of insufficient data availability and develop an innovative **Cloud Cover** product helping to insure seed crop during pollination under cloudy conditions.

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<td>Innovation for Cloud Cover</td>
<td>• Bayer Bio Science was facing a risk of loss of its seed crop on account of cloudy conditions during pollination</td>
<td>• The cover was successfully tested in sample of 200 acres.</td>
</tr>
<tr>
<td></td>
<td>• Due to lack of historical data for cloud coverage, insurance companies were not able to design a suitable product to cover the possible losses of Bayer</td>
<td>• Bayer is now working on a product launch.</td>
</tr>
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<td>• We designed a cover correlating rainfall of all weather stations within a 50 km radius of the cropped location to cover the risk of cloud cover.</td>
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As an **INSURER** you do not want errors in multi source data to add to your risk. A less than precise approach to underlying data can impact portfolio PML and change as-is payouts dramatically.

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<th>How we do it</th>
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| ➔ Multi source weather data is seldom cleaned and cross-referenced | ➔ This can drastically change the as-is payouts  
 ➔ Can have a major impact on portfolio PML | ➔ We provide independent cross-check on the data and generate a relevant Index  
 ➔ Index and Data is visible on the WeatherSecure Pricing Platform  
 ➔ Analysis of quality of yield information used to generate Index Values |
Using insights driven by our decade long experience to augment analysis, **insurers as well as reinsurers** can approach quotes aggressively or avoid unnatural risks with confidence.

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<td>→ Rain fed Jowar is a RABI Season crop</td>
<td>→ A normal pricing approach taking only yield data into account would result in significant pricing deviation</td>
<td>→ Using our experience to augment the analysis we could identify that almost all major payouts are correlated with deficit rainfall in the preceding season</td>
</tr>
<tr>
<td>→ The sowing occurs in the middle of October</td>
<td>→ Overpricing / Underpricing</td>
<td>→ Valuable information that is available while pricing risk</td>
</tr>
<tr>
<td>→ Karnataka doesn’t get rainfall during the RABI season</td>
<td>→ Significant variation in YoY yield data is unexplained</td>
<td>→ Insurer / Reinsurer could quote aggressively or avoid risk based on these insights</td>
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As a REINSURER you want an **accurate assessment of AS IS** to assume risk. Unavailable from Insurers, we combine ground stations, satellite records and surveys to give you a better picture to take on risks.

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| → Reinsurer was offered a portfolio to underwrite | → AS IS loss situation is usually not provided by insurer  
→ Difficult to gauge AS IS in case of yield insurance program | → We monitor loss situation on WBCIS portfolio using a network of ground stations and satellite weather records  
→ NDVI index is evaluated for crop situation analysis in MNAIS  
→ Quick ground surveys are conducted in high exposure districts to evaluate the crop situation |
The WeatherSecure platform is a hyper innovative solution for all stakeholders in agriculture insurance. Right from the farmer to a global reinsurer, we have everything in place for unlimited possibilities.

→ **30x30 Km²** weekly weather forecasts
→ Regional **Monthly** and **Seasonal** weather forecasts
→ **Yield Data** at 30x30 Km²
→ Satellite based **vegetative indices** at 50 Km²
→ Comprehensive **Disease**, **Flood** and **Drought** alerts.
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THANK YOU

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