weathersecure®

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

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

**Loss Cost Summaries**
- Industry 1st pricing tool
- Pre-fed term sheets

**Underlying Data**
- Direct DATA VIEW
- Large multi source weather database cleaned using meteorology software

**Non Data Factors**
- Expert Team of risk analysts
- Strong Onsite survey and assessment capability

**PML Estimation**
- GIS integrated PML analysis & area estimate
- Statistical Analysis for fat tail estimate
- Robust climate data sets

**AS IS LOSS Situation**
- Managed data network
- Estimation using NDVI and other proxies
- Quick AS IS turnaround
→ 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**
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.

\[ YPA = f(x_i) \]

- \( X_i \) = Meteorological Indices
- Vegetative indices
- Drought Index

\[ \text{Yield} = f(\text{NDVI}, \text{GDD}, \text{Rain Index, Ancillary data}) \]

**Multi Source Inputs**
- Remote Sensing Imagery / Weather Data
- Historical Weather Data / Fertilizer and Inputs
- Soil Detail / Irrigation Detail / Ground Truth

**Robust Modeling**
- Stasny - Goel Bayesian Method / Griffith AR Method
- Standard Ratio Estimation / Econometric Method
- Agro-Met Methodology / GIS Method
- Remote Sensing Methodology
### 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
- **Crop Stand Damage**: Count or % of crop stand area with no living axils/buds.
- **Crop Stem Damage**: Count or % of crop stem snapped off with inability to yield or inactive.
- **Branch Damage**: Position and % of branches snapped off or damaged.
- **Leaf Damage**: Count and % of leaves snapped off, shredded, de-colorized and inactive.
- **Ear/Pod/Head/Boll Damage**: Count and % of yield part knocked off/chaffed/shriveled/broken or disease/pest infected.

### 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
\[ Y = F \left( \text{Seed Weight} / \text{Plants} / \text{Row Width} / \ldots \right) \]

### Yield Loss
Normal Yield – Forecast Yield.
→ 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.

### Business Case
Cholamandalam wanted to establish a robust Crop Insurance Products portfolio.

### What we did
- 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.

### Impact
- 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.

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<th>Impact</th>
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| Large Scale implementation of subsidized weather insurance program | • 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. | • 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 10,000 farmers in Punjab.

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| Difficult to extend cover under existing Crop Insurance programs due to moral hazard | • 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. | • Program successfully running in its 9th year.  
• Covers 10,000 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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| Innovation for Cloud Cover | • Bayer Bio Science was facing a risk of loss of its seed crop on account of cloudy conditions during pollination  
• 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  
• 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. | • The cover was successfully tested in sample of 200 acres.  
• Bayer is now working on a product launch. |
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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<td>➔ Multi source weather data is seldom cleaned and cross-referenced</td>
<td>➔ This can drastically change the as-is payouts&lt;br&gt;➔ Can have a major impact on portfolio PML</td>
<td>➔ We provide independent cross-check on the data and generate a relevant Index&lt;br&gt;➔ Index and Data is visible on the WeatherSecure Pricing Platform&lt;br&gt;➔ Analysis of quality of yield information used to generate Index Values</td>
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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>
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<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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<td>→ Reinsurer was offered a portfolio to underwrite</td>
<td>→ AS IS loss situation is usually not provided by insurer</td>
<td>→ We monitor loss situation on WBCIS portfolio using a network of ground stations and satellite weather records</td>
</tr>
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<td>→ Portfolio already in the risk period</td>
<td>→ Difficult to gauge AS IS in case of yield insurance program</td>
<td>→ NDVI index is evaluated for crop situation analysis in MNAIS</td>
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<td>→ AS IS loss situation was required before assuming the risk</td>
<td></td>
<td>→ Quick ground surveys are conducted in high exposure districts to evaluate the crop situation</td>
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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.
weathersecure®

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

THANK YOU

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