

CLAIMS

1. A computer-implemented method of estimating crop pest risk and/or crop disease risk at sub-farm level, the method comprising:
 - receiving farm definition data;
 - determining a farm region based on the farm definition data;
 - retrieving input data associated with the farm region from a plurality of data sources, wherein the input data includes a plurality of pixel sets;
 - determining, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, wherein the crop risk data include an estimate of crop pest risk for each of the plurality of pixel sets and/or an estimate of crop disease risk for each of the plurality of pixel sets;
 - categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data.
2. The method as recited in claim 1, further comprising:
 - displaying, as a visual heat-map, one or more of the plurality of sub-farms.
3. The method as recited in claim 1, wherein determining, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models includes determining, for each of the plurality of pixel sets, temporal crop risk data at each of a plurality of different points in time.
4. The method as recited in claim 3, wherein categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data includes categorizing the farm region, at each of the plurality of different points in time, into a plurality of sub-farms each defining a risk level category for that sub-farm at that point in time based on the temporal crop risk data at each of the plurality of different points in time.
5. The method as recited in claim 4, further comprising:
 - displaying, as a visual heat-map, one or more of the plurality of sub-farms at a user-selected one of the plurality of different points in time.
6. The method as recited in claim 1, further comprising:
 - identifying, for each of the plurality of sub-farms, a plurality of antidote options;
 - determining, for each of the plurality of sub-farms, a recommendation score for each of the plurality of antidote options based at least in part on the risk level for that sub-farm;
 - providing, for each of the plurality of sub-farms, one or more recommended antidote options from the plurality of antidote options based on the plurality of recommendation scores.

7. The method as recited in claim 6, wherein, for each of the plurality of sub-farms, the plurality of antidote options include a plurality of sub-farm temporal antidote options defining antidote options for that sub-farm at a plurality of different points in time.
8. The method as recited in claim 6, further comprising:
 - displaying, as a visual heat-map, one or more of the plurality of sub-farms;
 - displaying, for each of the one or more of the plurality of sub-farms, the one or more recommended antidote options as text associated with that sub-farm on the visual heat-map.
9. The method as recited in claim 1, wherein categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data includes determining whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold, wherein the first one of the plurality of sub-farms adjoins the second one of the plurality of sub-farms, and wherein the candidate pixel set is adjacent a neighboring pixel set of the plurality of pixel sets in the first one of the plurality of sub-farms.
10. The method as recited in claim 9, wherein determining whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold comprises:
 - determining whether a difference between the crop risk data for the candidate pixel set and the crop risk data for the neighboring pixel set is less than a first sub-farm expansion threshold;
 - determining whether a difference between the crop risk data for the candidate pixel set and the crop risk data for each of the plurality of pixel sets in the first one of the plurality of sub-farms is less than a second sub-farm expansion threshold.
11. The method as recited in claim 10, further comprising:
 - receiving resolution selection data from a user, wherein the resolution selection data includes at least one of the first and second sub-farm expansion thresholds.
12. A system for estimating crop pest risk and/or crop disease risk at sub-farm level, comprising:
 - a server device, wherein the server device comprises one or more processors, one or more computer readable storage devices, and program instructions stored on at least one of the one or more computer readable storage devices for execution by at least one of the one or more processors, the program instructions executable to:
 - receive farm definition data;
 - determine a farm region based on the farm definition data;

retrieve input data associated with the farm region from a plurality of data sources, wherein the input data includes a plurality of pixel sets;

determine, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, wherein the crop risk data include an estimate of crop pest risk for each of the plurality of pixel sets and/or an estimate of crop disease risk for each of the plurality of pixel sets;

categorize the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data.

13. The system as recited in claim 12, wherein to determine, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, the program instructions further executable to:

determine, for each of the plurality of pixel sets, temporal crop risk data at each of a plurality of different points in time.

14. The system as recited in claim 13, wherein to categorize the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data, the program instructions further executable to:

categorize the farm region, at each of the plurality of different points in time, into a plurality of sub-farms each defining a risk level category for that sub-farm at that point in time based on the temporal crop risk data at each of the plurality of different points in time.

15. The system as recited in claim 12, wherein to categorize the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data, the program instruction further executable to:

determine whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold, wherein the first one of the plurality of sub-farms adjoins the second one of the plurality of sub-farms, and wherein the candidate pixel set is adjacent a neighboring pixel set of the plurality of pixel sets in the first one of the plurality of sub-farms.

16. The system as recited in claim 15, wherein to determine whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold, the program instructions further executable to:

determine whether a difference between the crop risk data for the candidate pixel set and the crop risk data for the neighboring pixel set is less than a first sub-farm expansion threshold;

determine whether a difference between the crop risk data for the candidate pixel set and the crop risk data for each of the plurality of pixel sets in the first one of the plurality of sub-farms is less than a second sub-farm expansion threshold.

17. The system as recited in claim 16, wherein to determine whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold, the program instructions further executable to:

receive resolution selection data from a user, wherein the resolution selection data includes at least one of the first and second sub-farm expansion thresholds.

18. A computer program product for estimating crop pest risk and/or crop disease risk at sub-farm level, the computer program product comprising a computer readable storage medium having program code embodied therewith, the program code executable by one or more processors, to perform a method comprising:

receiving farm definition data;

determining a farm region based on the farm definition data;

retrieving input data associated with the farm region from a plurality of data sources, wherein the input data includes a plurality of pixel sets;

determining, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, wherein the crop risk data include an estimate of crop pest risk for each of the plurality of pixel sets and/or an estimate of crop disease risk for each of the plurality of pixel sets;

categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data.

19. The computer program product as recited in claim 18, wherein determining, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models includes determining, for each of the plurality of pixel sets, temporal crop risk data at each of a plurality of different points in time.

20. The computer program product as recited in claim 19, wherein categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data includes categorizing the farm region, at each of the plurality of different points in time, into a plurality of sub-farms each defining a risk level category for that sub-farm at that point in time based on the temporal crop risk data at each of the plurality of different points in time.

21. The computer program product as recited in claim 18, wherein categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data includes determining whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel

sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold, wherein the first one of the plurality of sub-farms adjoins the second one of the plurality of sub-farms, and wherein the candidate pixel set is adjacent a neighboring pixel set of the plurality of pixel sets in the first one of the plurality of sub-farms.

22. The computer program product as recited in claim 21, wherein determining whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold comprises:

- determining whether a difference between the crop risk data for the candidate pixel set and the crop risk data for the neighboring pixel set is less than a first sub-farm expansion threshold;

- determining whether a difference between the crop risk data for the candidate pixel set and the crop risk data for each of the plurality of pixel sets in the first one of the plurality of sub-farms is less than a second sub-farm expansion threshold.

23. The computer program product as recited in claim 22, wherein determining whether to expand a first one of the plurality of sub-farms to include a candidate pixel set of the plurality of pixel sets in a second one of the plurality of sub-farms based on whether the candidate pixel set meets at least one sub-farm expansion threshold further comprising:

- receiving resolution selection data from a user, wherein the resolution selection data includes at least one of the first and second sub-farm expansion thresholds.

24. A system for estimating crop pest risk and/or crop disease risk at sub-farm level and recommending at least one antidote, comprising:

- a server device, wherein the server device comprises one or more processors, one or more computer readable storage devices, and program instructions stored on at least one of the one or more computer readable storage devices for execution by at least one of the one or more processors, the program instructions executable to:

- receive farm definition data;

- determine a farm region based on the farm definition data;

- retrieve input data associated with the farm region from a plurality of data sources, wherein the input data includes a plurality of pixel sets;

- determine, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, wherein the crop risk data include an estimate of crop pest risk for each of the plurality of pixel sets and/or an estimate of crop disease risk for each of the plurality of pixel sets;

- categorize the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data;

- identify, for each of the plurality of sub-farms, a plurality of antidote options;

determine, for each of the plurality of sub-farms, a recommendation score for each of the plurality of antidote options based at least in part on the risk level for that sub-farm;

provide, for each of the plurality of sub-farms, one or more recommended antidote options from the plurality of antidote options based on the plurality of recommendation scores.

25. A computer program product for estimating crop pest risk and/or crop disease risk at sub-farm level and recommending at least one antidote, the computer program product comprising a computer readable storage medium having program code embodied therewith, the program code executable by one or more processors, to perform a method comprising:

receiving farm definition data;

determining a farm region based on the farm definition data;

retrieving input data associated with the farm region from a plurality of data sources, wherein the input data includes a plurality of pixel sets;

determining, for each of the plurality of pixel sets, crop risk data based on the input data using one or more regression models, wherein the crop risk data include an estimate of crop pest risk for each of the plurality of pixel sets and/or an estimate of crop disease risk for each of the plurality of pixel sets;

categorizing the farm region into a plurality of sub-farms each defining a risk level category for that sub-farm based on the crop risk data;

identifying, for each of the plurality of sub-farms, a plurality of antidote options;

determining, for each of the plurality of sub-farms, a recommendation score for each of the plurality of antidote options based at least in part on the risk level for that sub-farm;

providing, for each of the plurality of sub-farms, one or more recommended antidote options from the plurality of antidote options based on the plurality of recommendation scores.