SYSTEMS AND METHODS FOR DYNAMIC RELEASE PLANNING FOR INSECT RELEASE

FIELD

[0001] The present disclosure generally relates to population control of wild insects and more specifically relates to systems and methods for dynamic release planning for insect release.

BACKGROUND

[0002] All continents except Antarctica suffer from the plague of mosquito-vectored diseases. Various techniques for the control of mosquito populations involve the generation of sterile male insects for release into the wild for mating with local females. These techniques require systems for releasing the reared insects into the wild.

SUMMARY

[0003] Various examples are described for systems and methods for dynamic release planning for insect release. One example method includes receiving insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region; for each insect trap, determining a number of wild insects per house within a predetermined radius of the respective insect trap based on the received insect information; ~~determining~~ identifying one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads; determining, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point indicating a release of a predefined quantity of insects and a predetermined release rate; and generating an insect release route through the geographic region, the insect release route passing through each insect release point.

[0004] In another example, a non-transitory computer-readable medium includes processor-executable instructions configured to cause a processor to receive insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region; for each insect trap, determine a number of wild insects per house within a predetermined radius of the respective insect trap

based on the received insect information; ~~determine~~ identify one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads; determine, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point indicating a release of a predefined quantity of insects and a predetermined release rate; and generate an insect release route through the geographic region, the insect release route passing through each insect release point.

[0005] In a further example, a system includes a non-transitory computer-readable medium; and a processor configured to execute processor-executable instructions stored in the non-transitory computer-readable medium, the

processor-executable instructions configured to cause a processor to receive insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region; for each insect trap, determine a number of wild insects per house within a predetermined radius of the respective insect trap based on the received insect information; ~~determine~~ identify one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads; determine, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point indicating a release of a predefined quantity of insects and a predetermined release rate; and generate an insect release route through the geographic region, the insect release route passing through each insect release point.

[0006] These illustrative examples are mentioned not to limit or define the scope of this disclosure, but rather to provide examples to aid understanding thereof. Illustrative examples are discussed in the Detailed Description, which provides further description. Advantages offered by various examples may be further understood by examining this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying drawings, which are incorporated into and constitute a part of this specification, illustrate one or more certain examples and, together with the description of the example, serve to explain the principles and implementations of the certain examples.

[0008] Figure 1 shows an example system for dynamic release planning for insect release;

[0009] Figure 2 shows an example geographic region having insect traps;

[0010] Figure 3 shows an example geographic region having insect traps and an insect release route for an insect release vehicle;

[0011] Figures 4A-4B show an example insect storage and release system;

[0012] Figure 5 shows an example insect release mechanism;

[0013] Figure 6 shows an example geographic region having insect traps, an insect release route for an insect release vehicle, and multiple insect release points;

[0014] Figure 7 shows an example geographic region having insect traps and multiple road segments;

[0015] Figure 8 shows an example geographic region having insect traps, multiple road segments, and multiple insect release points;

[0016] Figure 9 shows an example method for dynamic release planning for insect release; and

CLAIMS

That which is claimed is:

1. A method comprising:

receiving insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region;

for each insect trap, determining a number of wild insects per house within a predetermined radius of the respective insect trap based on the received insect information;

~~determining~~ identifying one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads;

determining, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point indicating a release of a predefined quantity of insects and a predetermined release rate; and

generating an insect release route through the geographic region, the insect release route passing through each insect release point.

2. The method of claim 1, further comprising:

determining a number of houses in the geographic region;

determining a number of insect release points based on a predetermined ratio of wild insects per house; and

wherein:

placing the one or more insect release points comprises placing the number of insect release points.

3. The method of claim 2, further comprising:

determining centroids of a plurality of houses within the geographic region;

for each house of the plurality of houses, determining a road segment of the one or more identified road segments within the geographic region corresponding to the respective house;

determining a weight for each determined road segment based on the respective corresponding houses; and

wherein placing the one or more insect release points comprises determining an even distribution of the one or more insect release points based on the weights and the determined road segments.

4. The method of claim 1, further comprising:

determining a number wild female insects per house;

determining a quantity of sterile male insects based on the number of wild female insects and a predetermined ratio.

5. The method of claim 1, further comprising:

receiving information indicating a number of trapped sterile male insects captured by one or more insect traps within the geographic region;

determining a longevity of sterile male insects previously released into the geographic region based on the number of trapped sterile male insects;

determining a quantity of sterile insects to release at each release point based on the longevity of sterile male insects.

6. The method of claim 1, wherein the insect release route indicates a travel speed of a release vehicle.

7. The method of claim 1, further comprising providing the insect release route to a release vehicle.

8. The method of claim 1, further comprising:

detecting arrival at an insect release point; and

activating an insect release mechanism.

9. The method of claim 8, wherein the insect release mechanism comprises a tube having a population of insects and a blower; and

wherein activating the release mechanism comprises:

activating the blower,

presenting a portion of the tube to the blower, and

moving the tube past the blower.

10. The method of claim 9, further comprising varying the movement of the tube past the blower based on a determined insect release rate.

11. The method of claim 1, further comprising, after generating the insect release route:

receiving additional information indicating an updated population of wild insects;

determining an updated number of wild insects per house;

adjusting a placement of at least one insect release point; and

updating the insect release route based on the adjusted insect release points.

12. The method of claim 1, wherein each insect release point has the same predefined quantity of insects.

13. The method of claim 1, wherein generating the insect release route is based on a type of release vehicle.

14. The method of claim 13, wherein the type of release vehicle is one of (i) a truck or sport utility vehicle, (ii) a motorcycle, (iii) a car, (iv) a drone, (v) a manned aircraft, (vi) a bicycle, or (vii) a person.

15. The method of claim 1, wherein generating the insect release route is based on one or more of (i) weather data, (ii) population density, (iii) building types within the geographic region, (iv) expected release height of the insect population, or (v) expected time of day of release.

16. A non-transitory computer-readable medium comprising processor-executable instructions configured to cause a processor to:

receive insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region;

for each insect trap, determine a number of wild insects per house within a predetermined radius of the respective insect trap based on the received insect information;

~~determine~~ identify one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads;

determine, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point

indicating a release of a predefined quantity of insects and a predetermined release rate; and

generate an insect release route through the geographic region, the insect release route passing through each insect release point.

17. The non-transitory computer-readable medium of claim 16, further comprising processor-executable instructions configured to cause a processor to:

determine a number of houses in the geographic region; and

determine a number of the insect release points based on a predetermined ratio of wild insects per house.

18. The non-transitory computer-readable medium of claim 17, further comprising processor-executable instructions configured to cause a processor to:

determine centroids of a plurality of houses within the geographic region;

determine a weight for each identified road segment based on the houses assigned to it; and

determine an even distribution of the one or more insect release points based on the weights and the identified road segments.

19. The non-transitory computer-readable medium of claim 16, further comprising processor-executable instructions configured to cause a processor to:

determine a number wild female insects per house;

determine a quantity of sterile male insects based on the number of wild female insects and a predetermined ratio.

20. The non-transitory computer-readable medium of claim 16, further comprising processor-executable instructions configured to cause a processor to:

receive information indicating a number of trapped sterile male insects captured by one or more insect traps within the geographic region;

determine a longevity of sterile male insects previously released into the geographic region based on the number of trapped sterile male insects;

determine a quantity of sterile insects to release at each release point based on the longevity of sterile male insects.

21. A system comprising:

a non-transitory computer-readable medium; and

a processor configured to execute processor-executable instructions stored in the non-transitory computer-readable medium, the processor-executable instructions configured to cause a processor to:

receive insect information indicating a population of wild insects within a geographic region, the insect information obtained from one or more insect traps within the geographic region;

for each insect trap, determine a number of wild insects per house within a predetermined radius of the respective insect trap based on the received insect information;

~~determine~~ identify one or more road segments of one or more roads from a plurality of road segments within the geographic region based on the numbers of wild insects per house and locations of houses along the one or more roads;

determine, based on the one or more identified road segments and the one or more houses, one or more insect release points, each insect release point indicating a release of a predefined quantity of insects and a predetermined release rate; and

generate an insect release route through the geographic region, the insect release route passing through each insect release point.

22. The system of claim 21, wherein the processor is further configured to execute processor-executable instructions configured to cause a processor to:

determine a number of houses in the geographic region; and

determine a number of insect release points based on a predetermined ratio of wild insects per house.

23. The system of claim 22, wherein the processor is further configured to execute processor-executable instructions configured to cause a processor to:

determine centroids of a plurality of houses within the geographic region;

determine a weight for each identified road segment based on the houses assigned to it; and

determine an even distribution of the one or more insect release points based on the weights and the identified road segments.

24. The system of claim 21, wherein the processor is further configured to execute processor-executable instructions configured to cause a processor to:

determine a number wild female insects per house;

determine a quantity of sterile male insects based on the number of wild female insects and a predetermined ratio.

25. The system of claim 21, wherein the processor is further configured to execute processor-executable instructions configured to cause a processor to:

receive information indicating a number of trapped sterile male insects captured by one or more insect traps within the geographic region;

determine a longevity of sterile male insects previously released into the geographic region based on the number of trapped sterile male insects;

determine a quantity of sterile insects to release at each release point based on the longevity of sterile male insects.