Short Note 8.1

Matlab Routine to Calculate Areal Coverage

MATLAB is a commercial software product from Mathworks, Inc. See www.mathworks.com.

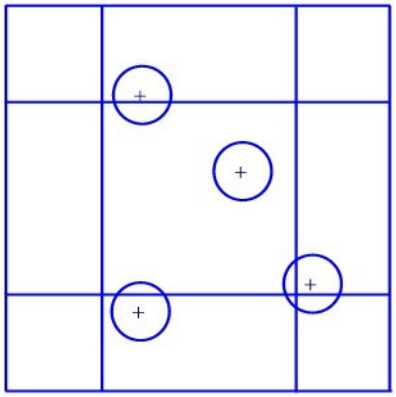
Open Model

```
%
%       ni =  number of infected trees
%       n  =  number of mesh lines in one direction
%       dx = cutting radius
%       x,y = infected tree locations
%       xt, yt = mesh point locations
%       d = calculated distance from mesh point to infected tree loc.
%       it = 0 if mesh point is outside the cutting circle
%          = 1 if mesh point is inside the cutting circle
%
clear;
n= 3000
dx = 1900
ni = 40;
delta = 5280/n
niter = 20;
for iter=1:niter;
  xt(1) = delta/2+ 2640;
  xt(2:n)= delta/2 + (1:n-1).*delta+ 2640;
  yt = xt;
  it(1:n,1:n) =0;
  x = rand(1,ni)*2*5280;y = rand(1,ni)*2*5280;
for ix = 1:n;
    for jx=1:n;
       for k =1:ni
          d = ((x(k)-xt(ix))^2 +(y(k) -yt(jx))^2)^0.5;
          if d < dx;
             if xt(ix) > 2640 & xt(ix) < 7920;
               if yt(jx) > 2640 & yt(jx) < 7920;
                    it(ix,jx) = 1;
               end
             end
          end
       end
    end
end
istat(iter) = sum(sum(it))/n^2;
end
mean(istat)
```

Closed Model:

```
%
%  --- Isolated Block Model
%
%       ni = number of infected trees
%       n =  number of mesh lines in one direction
%       dx = cutting radius
%       x,y = infected tree locations
%       xt, yt = mesh point locations
%       d = calculated distance from mesh point to infected tree loc.
%       it = 0 if mesh point is outside the cutting circle
%          = 1 if mesh point is inside the cutting circle
%
clear;
n= 300
dx = 125
;
ni = 10;
delta = 5280/n
niter = 300;
for iter=1:niter;
  xt(1) = delta/2;
  xt(2:n)= delta/2 + (1:n-1).*delta;
  yt = xt;
  it(1:n,1:n) =0;
  x = rand(1,ni)*5280;y = rand(1,ni)*5280;
for ix = 1:n;
    for jx=1:n;
        for k =1:ni
            d = ((x(k)-xt(ix))^2 +(y(k) -yt(jx))^2)^0.5;
            if d < dx;
                it(ix,jx) = 1;
             end
        end
    end
end
istat(iter) = sum(sum(it))/n^2;
end
mean(istat)
```

Program Notes for Inner Block model (Open Block)



There is an outer block, two mile on a side with a one mile square block (block of interest) centrally position within this outer block. There are "ni" infected trees randomly positioned in the outer square. For every iteration, a new set of infected trees are generated at x,y locations. A fine regular mesh of points (xt,yt) are generated within the inner block. The mesh spacing is variable "delta." Mesh starting point is ½ mile (2640 ft) plus delta/2 from the left and top edges.

The iteration step will iterate through all points in the mesh. For each mesh point, the program calculates the variable "d" as the distance from mesh point (xt, yt) to a specific infected tree point (x,y). If the distance is less than the the specified eradication radius, dx, then the mesh point is within the circle, and the array "it" for that mesh point is set equal to 1. The program repeats the distance calculations for all ni trees, then proceeds to the next mesh point. The program may set it(ix,jx) = 1 multiple times, since more than one circle may overlap a mesh point. This would not effect the final tally.

For the case of 10 infected trees within a square mile, the ni variable is set to 40, corresponding to 40 trees with a four square mile area.

The istat array is the sum of all mesh point values or the areal coverage for each iteration. The mean(istat) is the average area coverage of all circles for all iterations.

Program Notes for Isolated block model

This model ignores the contribution that eradication circles from outside the area of interest would have on areal coverage. Mesh starting point is delta/2 for both x and y coordinates. All other model notes as above would apply to the calculations.

Run Considerations

Run time and results accuracy are dependent on mesh spacing and number of iterations. For areal coverage expressed as a percentage, with two decimal point accuracy, at least 500 iterations were necessary.