UNIVERSIDAD POLITÉCNICA DE MADRID

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Global Strategy
IMPROVING AG-STATISTICS

IDENTIFYING THE MOST APPROPRIATE MASTER FRAME FOR AN INTEGRATED SURVEY

IDENTIFYING THE MOST APPROPRIATE AREA FRAME, LIST FRAME AND MULTIPLE FRAME FOR SPECIFIC LANDSCAPE TYPES, TAKING INTO ACCOUNT THE KIND OF DATA SOURCES AVAILABLE

LUIS AMBROSIO FLORES

A CONVENTIONAL MASTER SAMPLING FRAME

FEATURES of MASTER FRAMES:

1. Materials (Multiple Frames: Area&list)

Area Frames: Cartography, Satellite imagery

List Frames: Censuses, Agribusinesses

2. Concepts

Frame units

Sampling units

Statistical units

A CONVENTIONAL MASTER SAMPLING FRAME

HOUSEHOLDS SURVEYS

MULTIPLE FRAMES (Areas and Lists)

FRAME UNIT:
AREA FRAME: Enumeration area (EA)
LIST FRAME: Household

SAMPLING UNITS:

PSU: Cluster of *EA*s
***EA**:* 100 households
BLOCKS : 10 households

STATISTICAL UNITS:
Households
Persons

AGRICULTURAL SURVEYS

MULTIPLE FRAMES (Areas and Lists)

FRAME UNIT:
AREA FRAME: Parcel/Field
LIST FRAME: Farm

SAMPLING UNITS:

PSU: Cluster of fields and farms
SEGMENTS : Subcluster of fields and of farms

STATISTICAL UNITS:
Farms
Farmers
Fields

INTREGRATED SURVEYS

MULTIPLE FRAMES (Areas and Lists)

FRAME UNIT:
AREA FRAME: Parcel/Field
LIST FRAME: Farm and Household

SAMPLING UNITS:
PSU (Urban areas): 2 to 4 *EA*s
***EA*s** (Urban&rural): 10 Blks/Seg
BLOCKS (Urban): 10 Households
SEGMENTS (Rural):15 to 25 Parcels and 5 to 15 Farms

STATISTICAL UNITS:
Households and persons
Farms and farmers
Fields

A COST-EFFICIENCY APPROACH FOR IDENTIFYING THE MOST APPROPRIATE MASTER FRAME FOR LANDSCAPE TYPES

SAMPLING UNIT SIZE AND THE NUMBER OF SAMPLING STAGES CAN BE OPTIMIZED

COST-EFFICIENCY APPROACH

EFFICIENCY:

MODELING LANDSCAPE EFFECT ON SAMPLING ERROR

COST:

MODELING LANDSCAPE EFFECT ON COSTS

LANDSCAPE EFFECT ON SAMPLING ERROR

OPTIMIZING SAMPLING UNIT SIZE
LATTICE MODEL (DAS, 1950)

$$EV(\hat{\bar{Y}}_{su(r)}) = (1-\frac{\vartheta}{mn})\frac{1}{\vartheta lk}\sigma^2[1-\frac{mnlk-1}{mn-1}\Phi(ml,nk)+\frac{mn(lk-1)}{mn-1}\Phi(l,k)]$$

$$\Phi(l,k)=\frac{2}{l(lk-1)}\sum_{v=1}^{l-1}(l-v)\rho(0,v)+\frac{2}{k(lk-1)}\sum_{u=1}^{k-1}(k-u)\rho(u,0)+\frac{2}{lk(lk-1)}\sum_{u=1}^{k-1}\sum_{v=1}^{l-1}(k-u)(l-v)\Psi(u,v)$$

LANDSACAPE EFFECT ON SAMPLING ERROR IS MODELED USING THE CORRELOGRAM FUNCTION, $\rho(u,v)$

THE CORRELOGRAM FUNCTION IS INDEPENDENT OF THE FRAME UNIT SIZE. IT DEPENDS ONLY ON DISTANCES $u=\left(u_{s'}-u_s\right),\quad v=\left(v_{s'}-v_s\right)$

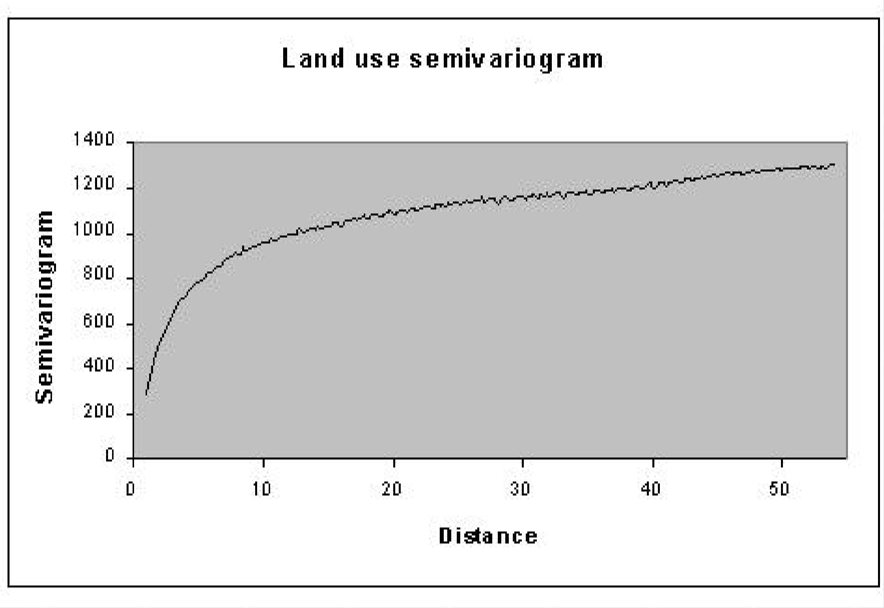
LANDSCAPE EFFECT ON COSTS

OPTIMIZING SAMPLING UNIT SIZE
LATTICE MODEL (DAS, 1950)

$$C_{jsu} = c_{10} t_{1j} n + c_{20} t_{2j} \frac{\sqrt{n}}{l}$$

LANDSACAPE EFFECT ON COSTS IS MODELED BY ASSIGNING TO EACH LANDSACPE TYPE “j” A (t_{1j}, t_{2j}) VALUE, ACCORDING TO THE DIFFICULTY OF OBSERVING STATISTICAL UNITS

EMPIRICAL SEMIVARIOGRAM FOR A SPECIFIC LANDSCAPE



CORRELOGRAM MODELS FOR EVALUATING THE EFFECT OF LANDSCAPE TYPES

EXPONENTIAL

$$\rho(u,v)=(1-\tau)e^{-h/a_0}$$

SPHERICAL

$$\rho(u,v)=\begin{cases}(1-\tau)\left[1-\frac{3}{2}\frac{h}{a_0}+\frac{h^3}{2a_0^3}\right]; h\le a_0\\ 0; h>a_0\end{cases}$$

RELATIVE EFFICIENCY AND DESIGN EFFECT OF A GIVEN SAMPLING UNIT SIZE

RELATIVE EFFICIENCY

$$RE_{su(r)/fu(r)} = \frac{EV(\hat{\bar{Y}}_{fu(r)})}{EV(\hat{\bar{Y}}_{su(r)})} = \frac{[1-\Phi(M,N)]}{[1-\frac{mnlk-1}{mn-1}\Phi(M,N)+\frac{mn(lk-1)}{mn-1}\Phi(l,k)]}$$

DESIGN EFFECT

$$DE_{su(r)/fu(r)} = \frac{[1-\frac{mnlk-1}{mn-1}\Phi(M,N)+\frac{mn(lk-1)}{mn-1}\Phi(l,k)]}{[1-\Phi(M,N)]}$$

OPTIMIZING SAMPLING UNIT SIZE IN A SPECIFIC LANDSCAPE

LAGRANGE'S FUNCTION

$$\psi\left(\boldsymbol{\theta}\right)=EV(\hat{\bar{Y}}_{su(r)})+\lambda\left(C_{jsu}-c_{10}t_{1j}\vartheta N_0-c_{20}t_{2j}\sqrt{\vartheta}\right)$$

$$\boldsymbol{\theta}=\left[N_0\ \vartheta\ \lambda\right]^T$$

ITERATIVE SOLUTION

$$\boldsymbol{\theta}^{(m+1)}=\boldsymbol{\theta}^{(m)}+\left[-\frac{\partial^2\psi\left(\boldsymbol{\theta}\right)}{\partial\boldsymbol{\theta}\partial\boldsymbol{\theta}^T}\Big|_{\boldsymbol{\theta}=\boldsymbol{\theta}^{(m)}}\right]^{-1}\frac{\partial\psi\left(\boldsymbol{\theta}\right)}{\partial\boldsymbol{\theta}}\Big|_{\boldsymbol{\theta}=\boldsymbol{\theta}^{(m)}}$$

TOPICS FOR FURTHER RESEARCHS

EXTENDING THE OPTIMIZING APPROACH TO:

1. THE GENERAL CASE, INSTEAD OF THE FIRST APPROXIMATION CONSIDERED HERE

2. HOSEHOLD SURVEYS (IDENTIFYING CORRELOGRAM MODELS)

3. MULTIPURPOSE SURVEYS (IDENTIFYING MULTIVARIATE SAMPLING ERRORS AND COST FUNCTIONS)

4. INTEGRATED SURVEYS

THANK YOU

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