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37. PREDICTION OF COST BENEFIT RATIO FOR DIVERSION OF FORESTLAND IN FORESTRY CLEARANCE IN INDIA

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INTRODUCTION

Mining is primary and one of the oldest activities of present. The activity starts with clearing of land. The land may be forest or non-forest. To start a mining activity the project proponent has to divert the forest land for no forestry use. The mining activity comes under non forestry use of the forest land for its different activity. For this the project proponent / user agency has to obtain clearance of forest land from Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India along with other statutory clearances. The forestry clearances are applied under section 2 (ii) and 2(iii) of FC Act 1980. For the diversion proposals applied under sec 2 (ii) of Fc Act 1980 there is requirement of assessing the damage caused by activities due for diversion of forest land for non-forestry purposes under Forest (Conservation) Act, 1980in terms of its impact of cost determined and benefits to be accrued. For this project proponent / user agency has to submit the report for cost benefit ratio (CBR) as per new guideline issued by Ministry of Environment, Forest & Climate Change, Government of India (MoEF&CC), New Delhi on 1st Aug'2017 brought a new guide line vide its circular no. 7-69/2011-FC(Pt.) in compliance with the NGT's order in Uttarakhand against displacement of forest dwellers due to Hydroelectric project. This guideline which replaces earlier guideline of 2004 lays down steps for estimating CBR with some modification from the earlier method for evaluating CBR as per provisions of section 2.6 of FC Act 1980.

2.0 COST BENEFIT ANALYSIS BEFORE AND AFTER 01.08.17

All the mining activities having forestland more than 20 hectares in plain and more than 5 hectares in hills require a CBR to be accompanied with forest application. In the new guideline Annexure VI(a) has been replaced by Table A, VI (b) replaced by Table B and VI (c) replaced by Table C.

Under head determined losses the point no. 1 which deals with "Loss of value of timber, fuel wood and minor forest products on an annual basis, including loss of man-hours per annum of people who derived lively hood and wages from the harvest of these commodities" was supplemented with introduction of concept of Net present value (NPV). In the new guideline economic value of loss of ecosystem services due to diversion of forest shall be Net present value (NPV) of the forest land being diverted. The point no. 2 which deals with Loss of animal husbandry productivity including loss of fodder. This will now be quantified and expressed in monetary terms or 10% of NPV applicable whichever is maximum. The point no. 3 deals with Cost of human resettlement (As per rehabilitation scheme) now will be quantified and expressed in monetary terms as per approved R&R plan. The point no. 4 which deals with Loss of public facilities and administrative Infrastructure (roads, buildings, schools, Dispensaries, electric lines, railways etc.) on forest land if these facilities were diverted due to the project will now be quantified and expressed in monetary terms on actual cost basis at the time of diversion. The point no. 5 dealing with Suffering to oustees was supplemented with social cost of rehabilitation of oustees (in addition to the cost likely to be incurred in providing residence, occupation and social services as per R&R plan) be worked out as 1.5 times of what oustees should have earned in two years has he not been shifted. The point no 6 dealing
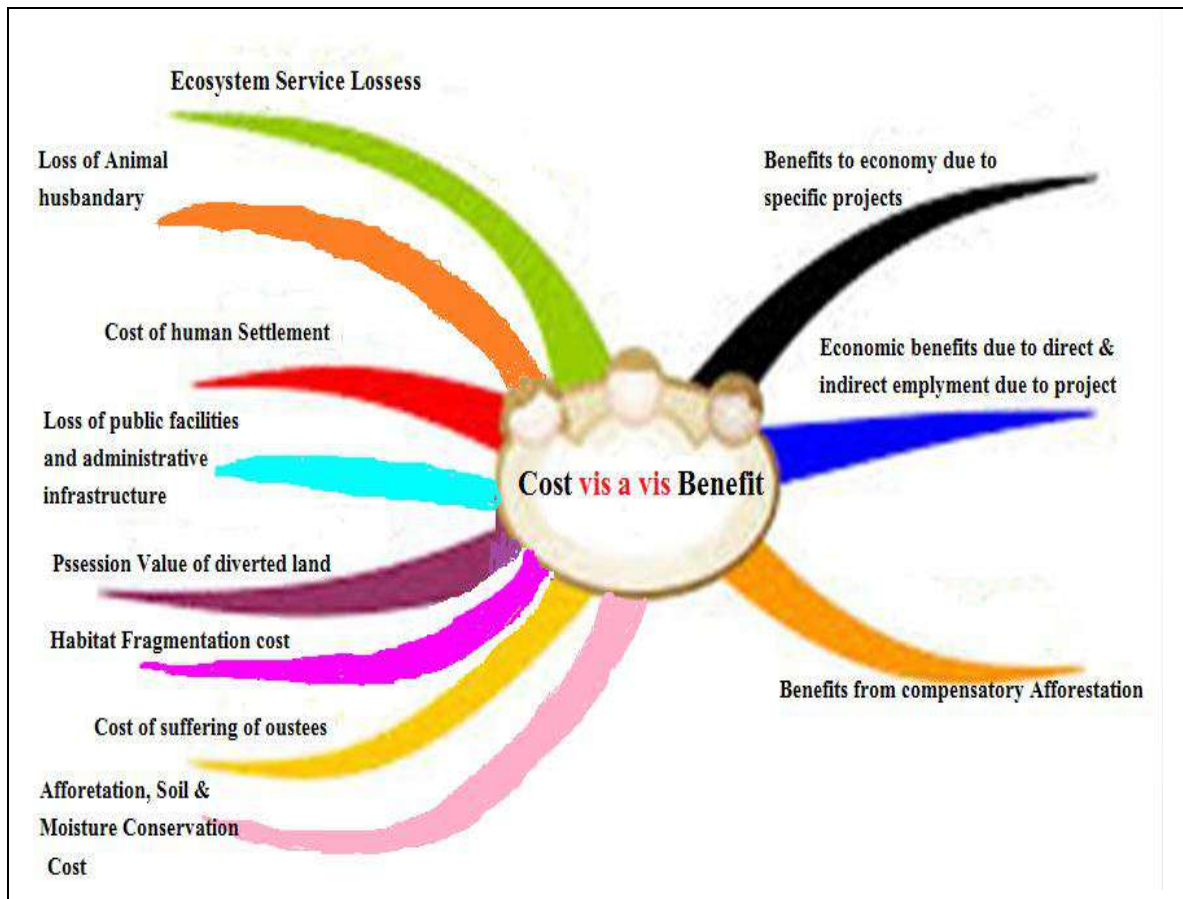
with Environmental losses(soil erosion, effect on hydrological cycle, wild life habitat, micro-climate upsetting of ecological balance) was omitted and 3 more numbers of parameters were added in determining the cost parameters. The point no. 6 will now deal with Possession value of forest land diverted:30% of environmental cost (NPV) due to loss of forest or circle rate of adjoining area in the district should be added as a cost component as possession value of forest land whichever is maximum. Point no. 7 will deal with Habitat Fragmentation cost which is the relationship between fragmentation and forest goods and services is complex, for the sake of simplicity the cost due to fragmentation has been pegged at 50% of NPV applicable as a thumb rule. Point no. 8 will deal with Compensatory afforestation and soil & moisture conservation cost which is the actual cost of compensatory afforestation and soil & moisture conservation and its maintenance in future at present discounted value. Under head accrued benefit point no. 1 Increase in productively attribute to the specific project will now be quantified & expressed in monetary terms avoiding double counting. Point no. 2 dealing with Benefits to economy due to specific project will now be treated as incremental economic benefit in monetary terms due to activities attributed to specific projects. Point no. 3 dealing with No. of population benefitted due to specific project will now be as per the detailed Project Report. Point no. 4 dealing with Employment potential is replaced by Economic benefits due to direct and indirect employment due to project and this is as per detailed Project Report. There will be no change in point no. 5 which deals with Cost of acquisition of facilities on non-forest land wherever feasible. Point no. 6, point no. 7 and point no. 8 dealing with Loss of agricultural & animal husbandry production due to diversion of forest land, Cost of rehabilitating the displaced persons as different from compensatory amount given for displacement and Cost of supply of free fuel wood to workers residing in or near forest area during the period of construction were omitted in new guideline and replaced as point no. 6 which will now consider Economic benefits due to Compensatory afforestation. Benefits from such compensatory afforestation accruing over next 50 years monetised and discounted to the present value should be included as benefits of compensatory afforestation.

2.1 Cost Benefit Ratio as per MoEF&CC guideline

The diversion of forests is indeed a tight rope walk with carrying the economic growth agenda forward on one side and fallouts of forest diversions on another side. It has to be made sure that the economic, physical and social benefits must outweighs the costs (Fig 2.1.1).

Cost to benefit ratio is the ratio obtained by dividing total cost determined to the total benefits accrued in the process of diversion of forest land for non-forestry purposes under Forest (Conservation) Act, 1980. The cost in one had is the summation of Ecosystem services losses due to proposed forest diversion, Loss of animal husbandry productivity, including loss of fodder, Cost of human resettlement, Loss of public facilities and administrative infrastructure, Possession value of forest land diverted, Cost of suffering of oustees, Habitat Fragmentation cost, Compensatory afforestation and soil & moisture conservation cost. While benefits on the other hand is the summation of benefits to economy due to specific project, economic benefits due to of direct and indirect employment due to project, economic benefits due to compensatory afforestation. The accrued benefits also include increase in productively attribute to the specific project and number of population benefitted due to specific project.

Fig 2.1.1: Cost & Benefit Parameter

Cost vis a vis Benefit

Ecosystem Service Lossess
Loss of Animal husbandary
Cost of human Settlement
Loss of public facilities and administrative infrastructure
Pssession Value of diverted land
Habitat Fragmentation cost
Cost of suffering of oustees
Afforetation, Soil & Moisture Conservation Cost

Benefits to economy due to specific projects
Economic benefits due to direct & indirect emplyment due to project
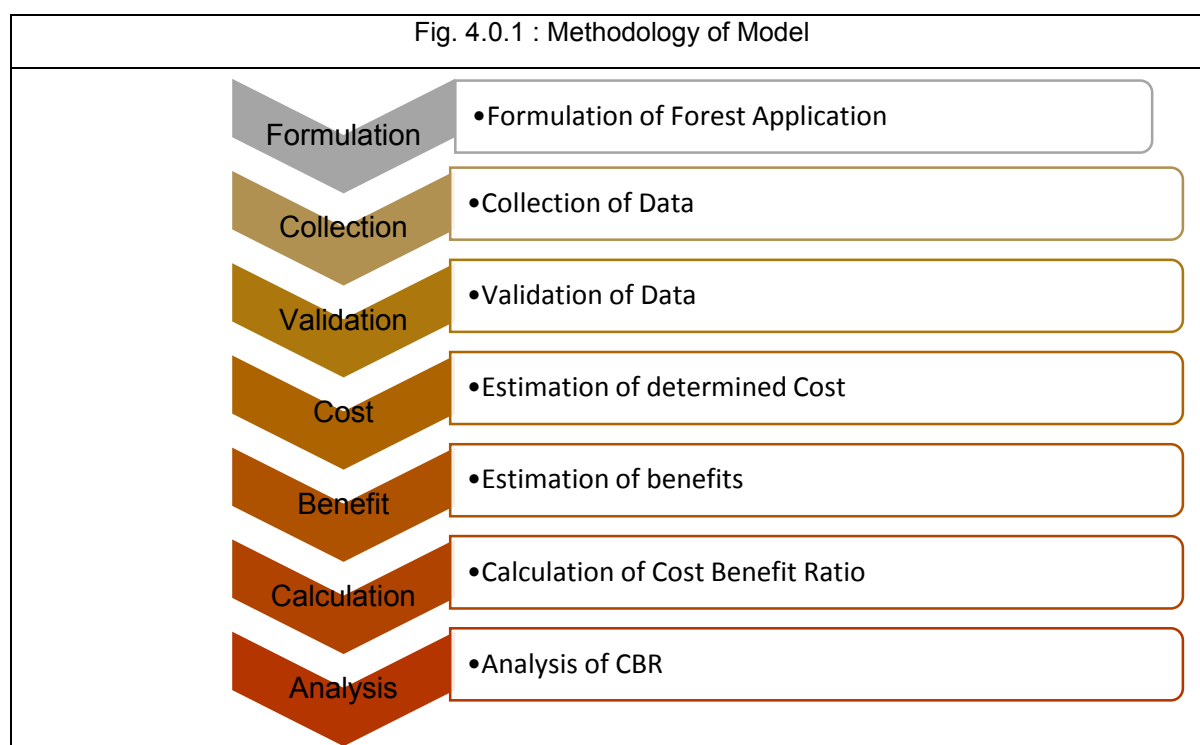Benefits from compensatory Afforestation

3.0 PURPOSE FOR MAKING COMPUTERISED MODEL FOR DETERMINING COST BENEFIT RATIO :

As per MoEF&CC circular no. 7-69/2011-FC(Pt.) dtd. 01 August, 2017, preparation of Cost benefit ratio analysis report has now become mandatory. Any application submitted to MoEF&CC for diversion of forest land for non-forestry use is to be accompanied with CBR analysis report and this report has to be prepared on the basis of new guideline dtd. 01.08.17. All the CBR report prepared earlier has to be modified on the basis of guideline dtd. 01.08.17.

4.0 METHODOLOGY:

As per MoEFCC circular no. 7-69/2011-FC(Pt.) dtd. 01 August, 2017 a computer aided model for prediction of Cost Benefit Ratio for obtaining Forestry Clearance under section 2 of FC Act 1980 has been developed. Accordingly a flow sheet (fig 4.0.1) has been developed for this purpose. The FC Act 1980 stipulates the provisions of forest diversion of forest land for non-forestry use in Indian subcontinent.

The methodology used in this model is at Fig 4.0.1.

Fig. 4.0.1 : Methodology of Model

- Formulation — •Formulation of Forest Application
- Collection — •Collection of Data
- Validation — •Validation of Data
- Cost — •Estimation of determined Cost
- Benefit — •Estimation of benefits
- Calculation — •Calculation of Cost Benefit Ratio
- Analysis — •Analysis of CBR

Altogether 41 equations contained in 16 box equation covering about 35 fixed and 46 variable input parameters have been used in this computer aided model.

4.1 Assumption :

This model works on following assumption:

1. Applicability is limited to only opencast coal mine, Underground, Washery and Linear Projects.

2. Software is based strictly on MoEFCC guidelines issued on 1st August 2017.

3. Assume No of Days in a Year =365, Av No of Days Working = 300, No of Days for calculating Subsistence allowance = 25, No_Days_considered for Land Less Tribal = 500, No of Days counted as per Govt. Scheme = 200

4. Assume Factor for conversion from Ha to Acre = 2.471, Acre to Ha = 0.4047, Dismal to Ha = 247.104

5. Assume Factor for Husbandry=60 kg, Income tax rate = 30%, Indirect employment = 5, Double Counting=0.8

6. Assume No. of Animal per PAF = 4, Family size of PAF = 4, Family Size of Beneficiary = 5

7. Assume Rate of Minimum Wage for Skilled labour= ₹ 604/day,Minimum Wage for Unskilled labour = ₹ 274/day, Minimum wage Agricultural labour = ₹ 300/day,

CoalCess = ₹ 400/te, GST = 18%, Monetary Compensation = ₹ 5 Lacs/ Acre, Alternate Housing = ₹ 3 laks/ family, Sales price of mineral as per recent notification.

4.2 Parameters used in Model :

The typical layout of the computer aided model is show at Fig. 4.2.1.

4.3 Benefits of Model

- Screening of Forest proposals for diversion of forest land for non-forestry use.

- Gain greater understanding of a process

- Identify problem areas or bottlenecks in processes

- Evaluate effect of systems or process changes such as Net present value, Compensatory afforestation, processional value, Human resettlement, and constraints

- Identify actions needed in given operation, organization, or activity to either improve or mitigate processes or events

- Evaluate impact of changes in policy prior to implementation

4.4 Limitation of Model

- Developed for Coal mining projects.

- This model can be used for CBA analysis for diversion of forest land for non-forestry use only.

- Different parameters assumed are site specific.

- Lack in understanding of physical systems working

4.5 Future Scope

1. Can be used for other minerals with slight modification

2. Can be developed for other linear projects like Road, Transmission Line etc.
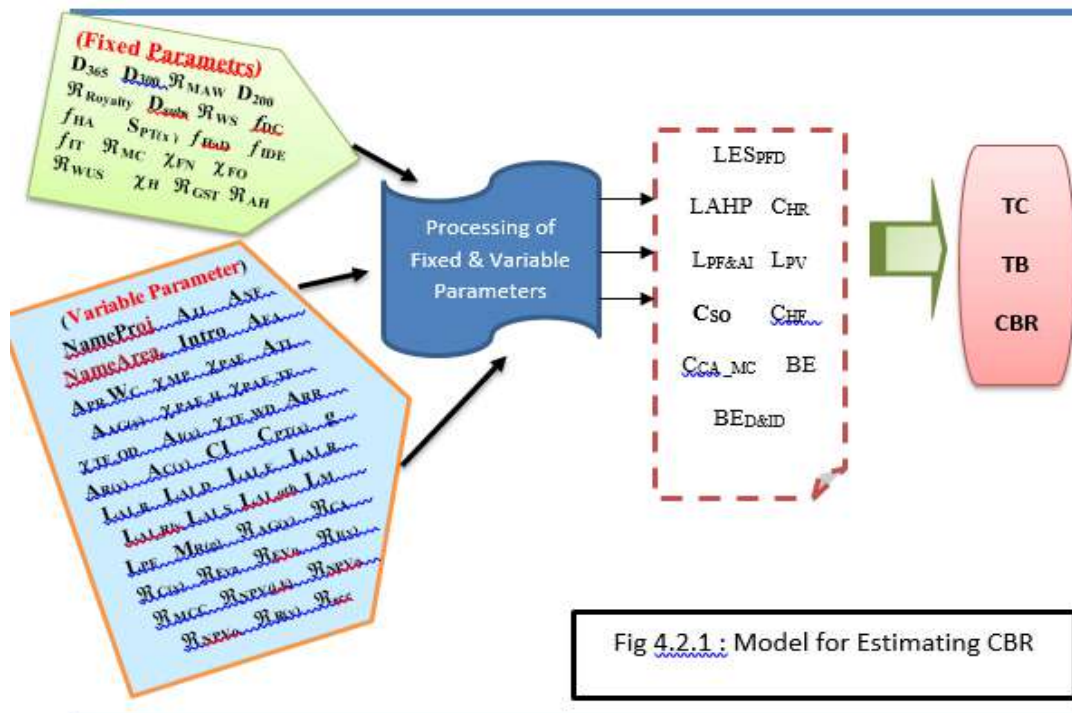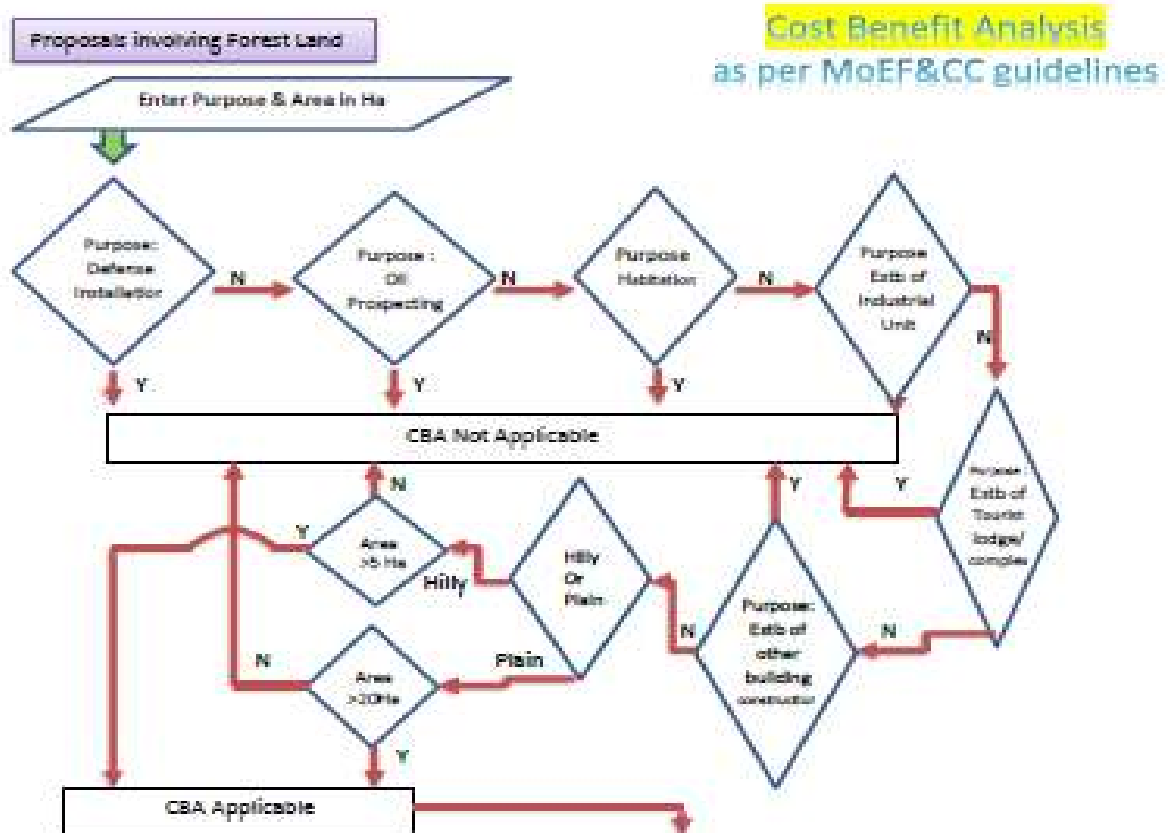
3. Can be developed for hybrid use.

Fig 4.2.1 : Model for Estimating CBR

Cost Benefit Analysis as per MoEF&CC guidelines

Enter Name of Forest

Enter Fix Data (24)

NoAnimalPAF, NoFamilySizePAF, NoFamilySizeREN,
NoDaysYear, NoDaysWorking, NoDaysSubs, No_Days_LLT,
NoDays_GovtScheme, FactorHaA, FactorAHa, FactorDHa,
FactorHusbandry, Factor_IT, Factor_IDE, Factor_DoubleCounting,
Rate_CompAlloc, Rate_MinWageSkilled, Rate_MinWageUnSkilled,
Rate_MAW, Rate_CoalCess, Rate_GST, Rate_MC, Rate_AltHouse,
SPT of diff grades of mineral

Variable Data (46)

NamePoj, NameArea, Intro, Area_ForestAppl, Area_TL, RR,
No_Grades, NoPAF, NoPAFTribal, AreaNF, AreaU, RateNPV,
Rate_NPV_CurrentCA, Rate_NPV_FinCA, Area_MinePlan, ManPower,
Eco_Class, Type_Forest, Type_LandVicinity, Capital_InvestPR,
Rate_FVA, Rate_PVO, RR_oth, NoPAFTribal_WD, NoPAFTribal_OE,
Area_BR, NoPAF_H, NoPAFTribal_H, Rate_WageCost,
NoVill_NR, Mine_Life, Rate_SCC, Rate_MCC, Loss_PF,
Loss_AI_R, Loss_AI_S, Loss_AI_D, Loss_AI_E,
Loss_AI_B, Loss_AI_Rly, Loss_AI_oth

Factor_FA_PR=(Area_ForestAppl/Area_MinePlan)
AreaForest=(AreaNF+AreaJJ)
LAHP_CAL=(NoPAF*NoAnimalPAF*NoDaysYear*FactorHusbandry*0.00001)
PV_CR=(Cost_Land)
Subs_Allow=(Rate_MinWageUnSkilled*NoDaysSubs*(NoPAF+(0.25*NoPAFTribal_OO))*12*0.00001)
Monetary_comp=(Rate_MC*(Area_TL_RR)*FactorHaA)
Comp_Pay_AltH=(Rate_AltHouse*((NoPAF-NoPAF_H)+0.25*NoPAFTribal_OO))
Comp_CR_TF=(Rate_MAW*No_Days_LLT*(NoPAFTribal_WD+(1.25 * NoPAFTribal_OO)*0.00001)
Loss_AI=(Loss_AI_R+Loss_AI_B+Loss_AI_S+Loss_AI_D+Loss_AI_E+Loss_AI_Rly+Loss_AI_oth)
Loss_CSO6=(1.5*Rate_MinWageSkilled*NoDaysWorking*2*NoPAF*NoFamilySizePAF*0.00001)
Loss_CA=(2*Rate_CompAFFor*Factor_DoubleCounting*(AreaForest)*0.00001)
Loss_MC= (Factor_DoubleCounting*AreaForest*Mine_Life*(Rate_SCC+Rate_MCC)*(0.00001))
PE_3=(ManPower*(1+Factor_IDE)*NoFamilySizeBEN)
BE_IDE=(Rate_MinWageUnSkilled*ManPower*Factor_IDE*NoDays_GovtScheme*0.00001)

NPV=(AreaForest*RateNPV*0.00001),
LAHP2=(LAHNPV)
Cost_HR3=(Subs_Allow+Monetary_comp+Comp_Pay_AltH+Comp_CR_TF)
Loss_PFAI4=(Loss_PF+Loss_AI)
PV_NPV=(0.3*NPV)
Loss_CA=(2*Rate_CompAFFor*Factor_DoubleCounting*(AreaForest)*0.00001)
Profit_1=(10*(((SPT_Steel_I-CPT)*MR_Steel_I)+((SPT_Steel_II-CPT)*MR_Steel_II)+((SPT_WI-CPT)*
  MR_WI)+((SPT_WII-CPT)*MR_WII)+((SPT_WIII-CPT)*MR_WIII)+((SPT_WIV-CPT)*MR_WIV)+ ((SPT_G1-
  CPT)*MR_G1)+((SPT_G2- CPT)*MR_G2)+ ((SPT_G3- CPT)*MR_G3)+((SPT_G5-
  CPT)*MR_G5)+((SPT_G6-CPT)*MR_G6)+((SPT_G7-CPT)*MR_G7)+((SPT_G8-CPT)*MR_G8)+((SPT_G9-
  CPT)*MR_G9)+((SPT_G10-CPT)*MR_G10)+((SPT_G11-CPT)*MR_G11)+ ((SPT_G12-CPT)*MR_G12)+((SPT_G13-
  CPT)*MR_G13)+((SPT_G14-CPT)*MR_G14)+((SPT_G15-CPT)* MR_G15)+((SPT_G16-CPT)*MR_G16)+((SPT_G17-
  CPT)*MR_G17)))
BE_Royalty=(0.14*10*Factor_DoubleCounting*((MR_Steel_II*SPT_Steel_II)+(MR_WI*SPT_WI)+(MR_WII*SPT_WII)+(MR_WIII
  I*SPT_WIII)+(MR_WIV*SPT_WIV)+(MR_G1*SPT_G1)+(MR_G2*SPT_G2)+(MR_G3*SPT_G3)+(MR_G4*SPT_G4)+(MR_G5*SPT_G5)
  +(MR_G6*SPT_G6)+(MR_G7*SPT_G7)+(MR_G8*SPT_G8)+(MR_G9*SPT_G9)+(MR_G10*SPT_G10)+(MR_G11*SPT_G11)+(MR_G12*
  SPT_G12)+(MR_G13*SPT_G13)+(MR_G14*SPT_G14)+(MR_G15*SPT_G15)+(MR_G16*SPT_G16)+(MR_G17*SPT_G17)))
BE_CST=(Rate_GST*Capital_InvestPR*Factor_FA_PR*Factor_DoubleCounting)
BE_Coal_Cess=(Rate_CoalCess * Factor_DoubleCounting * MR * 10)
BE_DE=(Rate_WageCost*MR*Factor_IT*10)
BE_CAO=((2*Factor_DoubleCounting*(AreaForest)*(Rate_NPV_FinCA-Rate_NPV_CurrentCA)*0.00001))

NPV_10=(0.1*NPV), NPV_30=(0.3*NPV), NPV_50=(0.5*NPV)
ESLPFD1=(NPV)
LAHNPV = (0.1*NPV)
Loss_PV5=PV_CR
Loss_HFC7=(0.3*NPV)
Loss_CR_MC8=(Loss_CA+(Factor_DoubleCounting*AreaForest*Mine_Life*0.00001*(Rate_SCC+Rate_MCC)))
BE_CSR=(0.02*Profit_1*Factor_DoubleCounting),BE_DMF=(0.3*BE_Royalty)
BE_NMF=(0.02*BE_Royalty)
Benefit_Eco_2=((0.3*BE_Royalty)+(0.02*BE_Royalty)+BE_CSR+BE_Royalty+BE_CST+BE_Coal_Cess+BE_NMF)
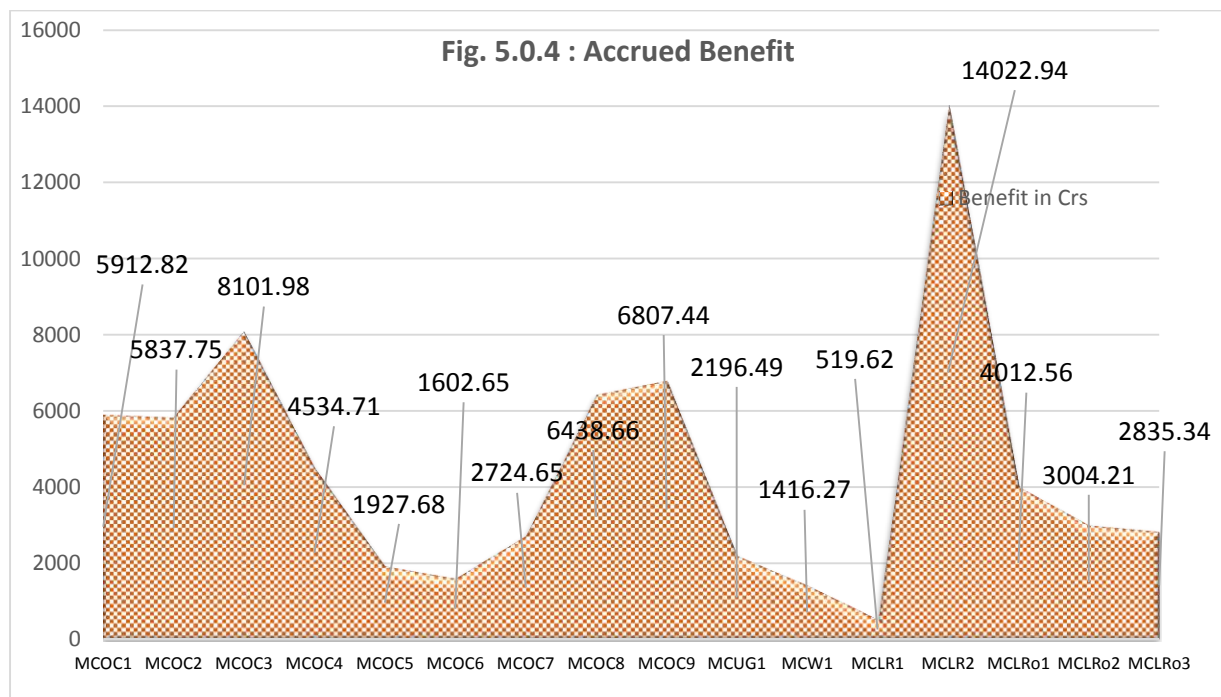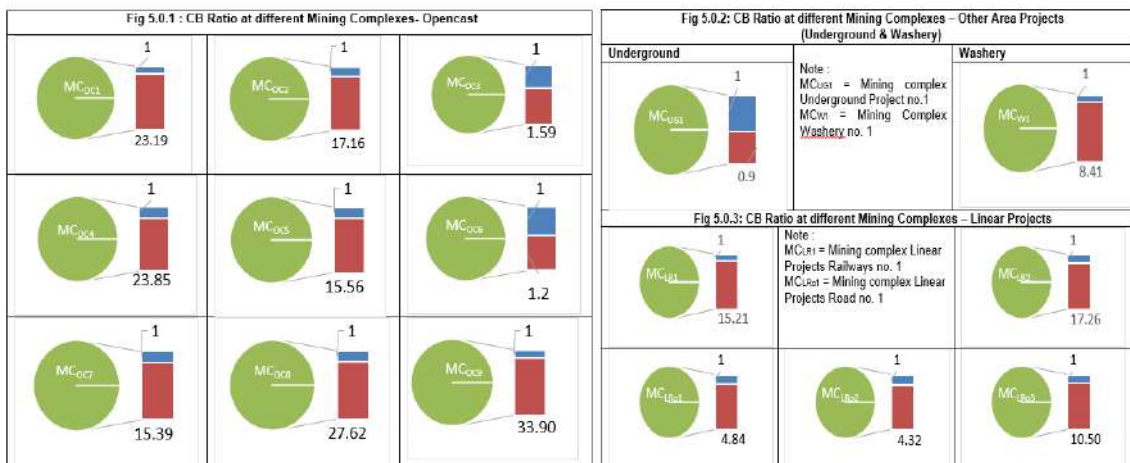BE_DEIDE_4=(BE_DE+BE_IDE)
BE_CA_5=(BE_CAO+BE_IDE)

Tot_Cost=(ESLPFD1+LAHP2+Cost_HR3+Loss_PFAI4+Loss_PV5+Loss_CSO6+Loss_HFC7+Loss_CR_MC8)
Tot_Ben=(Benefit_Eco_2+BE_DEIDE_4+BE_CA_5)
CB_Ratio=((Benefit_Eco_2+BE_DEIDE_4+BE_CA_5) /
          (ESLPFD1+LAHP2+Cost_HR3+Loss_PFAI4+Loss_PV5+Loss_CSO6+Loss_HFC7+Loss_CR_MC8))
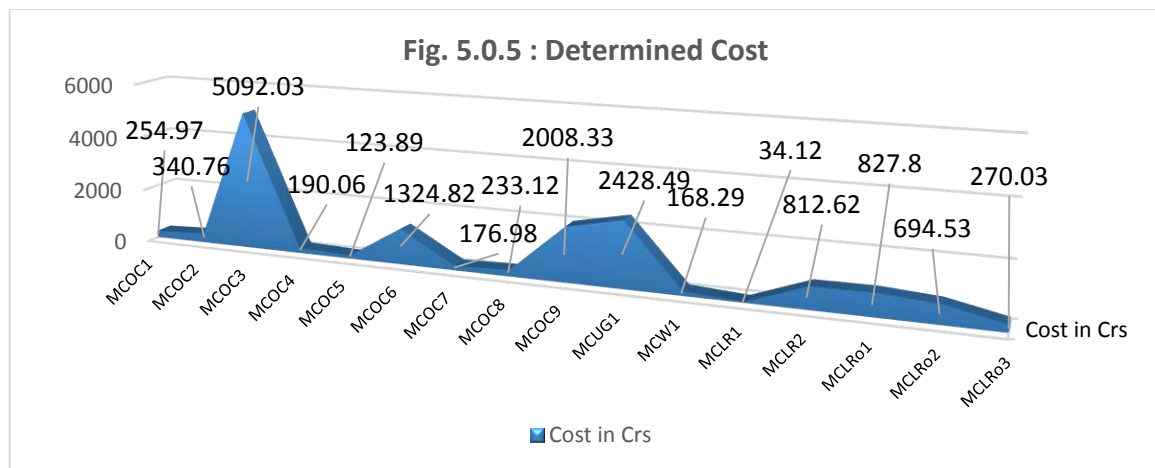
Print Report → **End** → **Stop**

Fig 4.0.1 : Flow Sheet CBR

5.0 ADMINISTRATION OF MODEL

This model has been administered over eleven numbers of forest proposal belonging to area module, nine of which is opencast coal mine (Fig. 5.0.1), one for underground coal mine (Fig. 5.0.2) and one for washery (Fig. 5.0.2). This computerised model has also been administered over two numbers of linear projects related to forest proposals for railway siding (Fig. 5.0.3). These all forest proposals were selected from different coalfields East Bokaro Coalfields, Ramgarh Coalfields, West Bokaro Coalfields and North Karnpura coalfields of Jharkhand. The forest proposals falls in different districts Jharkhand, India. Total cost determined as per table B and accrued benefit as per table C of the guidelines for CBA issued by MoEFCC, GoI, New Delhi, have been calculated presented at Fig 5.0.4.

Fig 5.0.1 : CB Ratio at different Mining Complexes- Opencast

Fig 5.0.2: CB Ratio at different Mining Complexes – Other Area Projects (Underground & Washery)

Fig 5.0.3: CB Ratio at different Mining Complexes – Linear Projects

Fig. 5.0.4 : Accrued Benefit

Fig. 5.0.5 : Determined Cost

6.0 CONCLUSION:

Analysis of the Cost Benefit Ratio is a useful tool to predict the damage caused by activities due for diversion of forest land falling in the mining lease which were are recorded as forest in govt. recorded or after the FC Act, 1980, came into force, for non-forestry purposes under Forest (Conservation) Act, 1980, in terms of its impact of cost determined and benefits to be accrued. The social, physical and economic benefits accruing clearly outweighs the determined cost.The meticulously thought out factors contributing to costs and benefits with their computer modelling using 16 numbers of box equation have been envisaged to provide cost – benefit results in order to facilitate a fast decision making process towards disposal of FC application. This model has been administered over 13 nos. of forest proposal in different category at four different coalfields of Jharkhand and of major coal producing company of India. The CBR for the different forest proposal were found to be in range of 1: 0.9 to 1: 33.90. The CBR for the different forest proposal for opencast, Underground, washery, Railways, Road were found to be in range of 1: 1.2 to 1: 33.90, 1: 0.9, 1: 8.41, 1: 15.81 to 1: 17.26 and 1: 4.32 to 1: 17.26 respectively. 22 % CBR falls under fair category, 78 % under better category.The analysis will provide valuable services to mine managers involved in planning & shaping a mine taking into account of forestry clearance. This study will prove to be helpful for mine mangers and managers of similar industries for estimating CBR.

7.0 ACKNOWLEDGEMENTS:

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